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QUANTITATIVE ANALYSIS

PART I
"UNCONVENTIONAL GAINS FROM TRADE"

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"UNCONVENTIONAL GAINS FROM TRADE"

by

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A b s t r a c t

In the introduction to the paper the authors explain their motivation for the study of unconventional gains from trade. They make three stylized observations about the pattern of trade within the Council for Mutual Economic Assistance (CMEA) for the period 1960 - 1980:

- (i) the Soviet Union has been "subsidizing" certain Eastern European countries by exporting "hard goods" (fuels, non-food raw materials, food and raw materials for food) at prices below world market prices in exchange for imports of "soft goods" (machinery, equipment and industrial consumer goods) at prices above world market prices, especially if account is taken of the relatively lower quality of Eastern European manufactures in comparison with their Western counterparts;
- (ii) within CMEA, trade between any two Eastern European countries exhibits balanced trade in "hard goods" and balanced trade in "soft goods";
- (iii) Soviet national security is produced from a combination of Soviet troops and military hardware within the Soviet Union, Soviet troops and military hardware stationed in Eastern Europe, and the allegiance of Eastern European countries.

The first observation indicates that two different sets of terms of trade exist simultaneously for the Soviet Union -- prevailing terms of trade on the world market as well as what appear to be inferior terms of trade with Eastern European countries. The second observation indicates that Soviet trade behavior within CMEA is unique and therefore some special aspect of the Soviet Union's relationship to Eastern Europe may hold the key to understanding the presence of two sets of terms of trade. The third observation implies that the allegiance of Eastern European countries can serve as a substitute for the use of Soviet labor and capital in providing security services. Because the Soviet Union is the dominant power within CMEA, the authors contend that it utilizes this tradeoff.

The authors introduce the concept of unconventional gains from trade, by which they mean non-market benefits of bilateral agreements which are secured through preferential trade treatment. These non-market benefits of bilateral agreements may be categorized into four classes: military, political, economic, and ideological. The most important types of military benefits are: (i) creation and maintenance of military alliances; (ii) absence of threat (pacification impact); (iii) availability of military bases in strategic locations; (iv) access to military technology, know-how, and training; (v) proxy intervention (availability of modern-day international mercenaries); (vi) possibility of importing military services in the case of an internal conflict; and (vii) ability to consume another country's defense services (free-rider aspect of defense as a public good). Potential political benefits include voting along alliance lines in international forums (United Nations, other international organizations), informal foreign government and media support, and the support and friendship of a foreign population. Unconventional economic benefits include increased economic stability, reduced risk of disrupted flow of strategic commodities, and reduced risk of refusal to purchase a country's exports for reasons other than

their price-competitiveness. Possible ideological byproducts of bilateral agreements primarily occur in three areas: acceptance of a desired political ideology and its propagation to other countries, achievement of religious unity, and strengthening of ethnic solidarity.

In Section II the authors discuss compensating transfer payments by a large country, which unilaterally has the power to decide on the extent of military and political association with another country, to a smaller country, which potentially is a source of external military and political benefits which can be produced at no extra cost in terms of real resources. The authors argue that in the case of divergence of preferences between the government of a large country (e.g., the USSR) and the population of a small country (e.g., any country in Eastern Europe), there may be a need to compensate the population of the small country for the loss of sovereignty. However, the population of the small country will not generally be better off in association with the large country because it is not necessary to compensate it fully for the loss of sovereignty (in view of the human and economic cost of a rebellion against the dominant foreign power).

Different ways of generating non-market benefits are discussed in Section III. These include export and import subsidies, quota allocation, preferential tariff treatment, and export permits. Since the generation of non-market benefits by means of preferential trade treatment may cause various distortions in the economy trying to generate them (the standard optimality condition: marginal rate of transformation = marginal rate of substitution = uniform international terms of trade may have to be violated), a question arises why these non-market benefits are not generated by payment in the form of direct grants. The reason for this is that in many situations direct grants are inappropriate or even impossible to use.

One such situation would occur if the population of the large country does not approve of its government subsidizing the per capita consumption of material goods in another country. This situation would be even more serious if the level of the per capita consumption in the donor country is already below that of the recipient country. To prevent social unrest in the large country, hidden trade subsidies may be viewed by the government of the donor country as a safer means, when compared to direct grants, of securing political allegiance and/or military benefits from the small country.

The reason why the authors deal with non-market benefits is that market exchange for these benefits would sometimes be considered (ethically) unacceptable. Public auctions of "country votes" in international forums are nonexistent, non-aggression pacts do not appear on the open market, and populations do not readily exchange religious or ideological beliefs for material handouts.

The second reason to secure the above-mentioned non-market benefits through a covert payment system, such as preferential trade treatment, is that preferences of governments differ frequently from the preferences of populations. Since a government makes decisions, yet it does not wish to alienate its population, a government may wish to conceal both the nature and the payment procedure of certain bilateral agreements. For the issues under discussion here, the most important differences in preferences between governments and populations are likely to be caused by differences in the extent to which self-esteem, pride, cultural heritage, ethnic background and other non-economic values enter into the respective utility calculations.

The third reason to employ a less explicit way to generate non-market benefits is that government officials are not held accountable for actions about which the population does not know. This consideration may be particu-

larly relevant here because it is difficult to assign a monetary value to the non-market benefits under discussion.

A final point against the use of direct grants is related to the public good aspects of defense. A country's military force may not have to be increased in size in order to offer protection or deterrence to a neighboring country. Nonetheless, the neighboring country may wish to donate a cost share for those services in order to strengthen the other country's willingness to maintain such a defense structure. However, in a democratic country it probably would be very difficult to persuade legislators to support a system of direct grants to a militarily powerful ally for what appears to be a public good, especially since the benefits of the public good are conditional upon a spectrum of possible future events. Legislators or other decisionmakers may believe that voters are unable to appreciate fully the range of possible future states of the world, and thus unable to understand the insurance-like benefits of the externality.

In Section V the authors present a diagrammatical exposition of optimal trade policy for the large country given the presence of unconventional gains from trade. The key result is that even in the presence of unconventional gains from trade, the optimal trade behavior of the large country requires the equality between the marginal rate of substitution, the marginal rate of transformation, relative prices (terms of trade) inclusive of non-market benefits with a particular small partner country, and relative prices (terms of trade) with the rest of the world. This result is important because it allows for the presence of bilateral terms of trade which differ from world market terms of trade and because the large country will typically trade both with a small country offering non-market benefits at what appear to be inferior terms of trade, and with the rest of the world at what appear to be superior world market terms of trade. In addition, in Appendices I, II, and III, various extensions of the simple diagrammatical model presented in Section V are discussed.

In summary, the authors conclude that the presence of unconventional gains from trade arises because of conflicts among the preferences of different groups in society, which motivate government officials to choose bilateral preferential trade treatment as a hidden way to generate the non-market benefits associated with bilateral agreements. One manifestation of bilateral preferential trade treatment is the existence of two sets of terms of trade. Given the two sets of terms of trade, an economy's equilibrium position will be defined relative to the terms of trade on which the marginal trade transaction was based and relative to the change in endowment due to the implicit transfer of resources.

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I. Introduction

Consider the following three stylized observations for the period 1960-1980:

- (i) within the Council for Mutual Economic Assistance (CMEA), the Soviet Union has been "subsidizing" certain Eastern European countries by exporting "hard goods" (fuels, non-food raw materials, food and raw materials for food) at prices below world market prices in exchange for imports of "soft goods" (machinery, equipment and industrial consumer goods) at prices above world market prices, especially if account is taken of the relatively lower quality of Eastern European manufactures in comparison with their Western counterparts;¹
- (ii) within CMEA, trade between any two Eastern European countries exhibits balanced trade in "hard goods" and balanced trade in "soft goods";
- (iii) Soviet national security is produced from a combination of Soviet troops and military hardware within the Soviet Union,

Soviet troops and military hardware stationed in Eastern Europe, and the allegiance of Eastern European countries.

The first observation indicates that two different sets of terms of trade exist simultaneously for the Soviet Union -- prevailing (two-way) terms of trade on the world market as well as what appear to be inferior one-way terms of trade with Eastern European countries.² However, international trade theory argues that the profit opportunities inherent in arbitrage effectively exclude the possibility that two different sets of terms of trade exist simultaneously. Thus the first observation suggests that the assumptions underlying international trade theory do not hold completely for the Soviet Union.

The second observation indicates that Soviet trade behavior within CMEA is not typical of other bilateral trade behavior within CMEA. Instead, bilateral barter between Eastern European countries may be expected to produce trade flows which do not show any clear pattern of subsidization.³ Therefore, some aspect of the Soviet Union's relationship to Eastern Europe, other than socialist or ethnic solidarity, may hold the key to understanding the presence of the two sets of terms of trade.

The third observation implies that the allegiance of Eastern European countries can serve as a substitute for the use of Soviet labor and capital in providing security services. Because the Soviet Union is the dominant power within CMEA, it is our contention that the Soviet Union utilizes this tradeoff. In other words, the Soviet Union

engages in preferential trade treatment in order to sustain the allegiance of Eastern European countries.

These observations motivated us to study the relationship between bilateral preferential trade treatment and the non-market benefits associated with bilateral agreements. We refer to non-market benefits of bilateral agreements which are secured through preferential trade treatment as unconventional gains from trade. If unconventional gains from trade exist, then the presence of two terms of trade is not surprising since a country may be willing to engage in bilateral preferential trade treatment as a means of obtaining the byproducts of bilateral trade.

Non-market benefits of bilateral agreements may be categorized into four classes: military, political, economic, and ideological.⁴ The most important types of military benefits are: (i) creation and maintenance of military alliances; (ii) absence of threat (pacification impact); (iii) availability of military bases in strategic locations; (iv) access to military technology, know-how, and training; (v) proxy intervention (availability of modern-day international mercenaries); (vi) possibility of importing military services in the case of an internal conflict; and (vii) ability to consume another country's defense services (free-rider aspect of defense as a public good). Potential political benefits include voting along alliance lines in international forums (United Nations, other international organizations), informal foreign government and media support, and the support and friendship of a foreign population. While most economic benefits of bilateral trade agreements are conventional in nature, several may be considered unconventional:

increased economic stability, reduced risk of disrupted flow of strategic commodities, and reduced risk of refusal to purchase a country's exports for reasons other than their price-competitiveness.⁵ Possible ideological byproducts of bilateral agreements primarily occur in three areas: acceptance of a desired political ideology and its propagation to other countries; achievement of religious unity; and strengthening of ethnic solidarity.

This paper focuses on the setting for and importance of unconventional gains from trade, then outlines an optimal trade policy for a situation in which unconventional gains from trade are prominent. Since the unconventional gains to which we refer are mainly of a military and political nature, several questions are likely to arise. Why would any country engage in preferential trade treatment when the outcome of a conventional military alliance is more military security and lower defense costs for all participants? Why should allegiance be sustained by a transfer payment via a trade-related subsidy rather than a direct grant? Do trade-related subsidies occur in large enough magnitudes to warrant our attention? In the next several sections we attempt to answer these questions. We also present a simplified diagrammatical exposition of a country's optimal behavior when faced with two different sets of terms of trade, one of which is related to the presence of unconventional gains from trade.

II. Compensating Transfer Payments

Suppose two nations form an alliance and each contributes a positive level of military forces. Suppose further that the joint military force is larger than either of the pre-alliance forces.⁶ Then both nations benefit from the alliance through more military security and lower defense costs. It appears that no compensating transfer payment is required because both nations are better off than they would be in the absence of the alliance. One assumption underlying this result is that the extra security can leave both nations better off. We will examine this assumption more carefully.

It is reasonable to assume that the formation of an alliance improves the position of both nations if the interests of the governmental decisionmakers in each country are the interests of the population and neither nation dominates the other. Otherwise, particular groups in each country may be seriously disadvantaged.⁷

Consider two economies, POLECON and EXECON. Let POLECON represent a politicized economy which unilaterally has the power to decide on the extent of military and political association between the two countries. Let EXECON represent an economy which potentially is an external source of military and political benefits for POLECON, benefits which can be produced at no extra cost in terms of real resources. Assume that the governments of POLECON and EXECON share mutual interests.

By assumption, POLECON's government has the power to choose the extent of military and political association with EXECON. Moreover,

suppose POLECON realizes that EXECON's population interprets greater association as meaning less sovereignty. In fact, the dissatisfaction of EXECON's population with such an association could lead to some form of domestic instability. Neither EXECON's government nor POLECON's government wants to face domestic instability in EXECON which could cause a change in leadership or social system. So POLECON's government, out of self-interest, may decide to partially compensate EXECON for the loss of sovereignty by transferring resources which are to be used to increase EXECON's per capita consumption of material goods and services. EXECON's population does not need to be aware of either the existence or the source of the subsidy, but it must translate the higher per capita consumption into more satisfaction with EXECON's government, which increases the probability of domestic stability.

POLECON, once having made the decision on the extent of association, could be viewed as facing the following choice:

- A: Association with EXECON, no transfer of resources to EXECON, P_A probability of social stability in EXECON;
- B: Association with EXECON, transfer of resources to EXECON, P_B probability of social stability in EXECON;

where $P_B > P_A$ because EXECON's population is being partially compensated for the loss of sovereignty. Suppose POLECON chooses alternative B.

EXECON's population in deciding whether to maintain domestic stability confronts a situation already influenced by the decision of

POLECON's government to associate with EXECON and to transfer real resources to EXECON as partial compensation for this association. EXECON's population has to decide whether to attempt to end the association with POLECON, which may be expressed as the following choice:

- A: Rebellion which would imply Q_A probability of no association with POLECON, H_A level of physical health, C_A level of per capita consumption with Q_A probability and C_B level of per capita consumption with $(1 - Q_A)$ probability;
- B: No rebellion which would imply certain association with POLECON, H_B level of health, and C_B level of per capita consumption;

where Q_A is the probability that the rebellion is successful, $H_A < H_B$ due to the death and injury costs of rebellion, and $C_A < C_B$ because a successful rebellion would mean the end of the compensating transfer from POLECON and a short-term decline in per capita consumption.

Alternative A not only implies a lower level of per capita consumption but also a lower level of physical health. So EXECON's population may choose alternative B, even though the partial compensation received from POLECON may not offset fully the decrease in utility due to EXECON's loss of sovereignty. Thus the presence of a compensating transfer payment may be interpreted as a revealed preference proof that POLECON is receiving benefits from association with EXECON (assuming the absence of altruism), yet it does not imply that EXECON's population is better off than it would be without association.

Thus we have argued that a divergence of preferences between POLECON's government and EXECON's population may create a situation in which POLECON partially compensates EXECON for the loss of sovereignty. Revealed preference indicates when POLECON is better off with the increased probability of social stability in EXECON. When EXECON's population decides not to rebel, then we know by revealed preference that EXECON's population views the decrease both in physical health ($H_B - H_A$) and in per capita consumption ($C_B - C_A$) as too high a price to pay for Q_A probability of disassociation with POLECON. Moreover, EXECON's population would not be better off in association with POLECON as long as POLECON does not fully compensate EXECON for the loss of sovereignty, POLECON has an incentive not to fully compensate EXECON's population because the death and injury cost of rebellion, under any compensation scheme, acts as a deterrent to rebellion in EXECON. POLECON's goal is not to provide full compensation to EXECON for the loss of sovereignty, but is the absence of rebellion.

III. Different Ways of Generating Non-Market Benefits

Various types of non-market benefits discussed above can be generated by preferential trade treatment, of which the most important types are export subsidies, import subsidies, quota allocation, preferential tariff treatment, and export permits.⁸ In addition, some of these non-market benefits can be obtained by direct payment in the form of either a per unit subsidy or a lump-sum grant, or can be obtained in exchange for various forms of foreign aid.⁹ We will refer to these direct means of securing non-market benefits as direct grants.

Since the generation of non-market benefits by means of preferential trade treatment may cause various distortions in the economy trying to generate them (the standard optimality condition $MRT = MRS =$ uniform international terms of trade may have to be violated), a question arises why these non-market benefits are not generated by payment in the form of direct grants. While in some cases this may be possible, in addition to being the most efficient way of generating them, there are other situations in which direct grants are inappropriate or even impossible to use. Let us consider several of these other situations. To do this, let us revert to the example of POLECON and EXECON.

One such situation would occur if POLECON's population does not approve of its government using taxes to increase EXECON's per capita consumption of material goods. This situation would be more serious if POLECON's own per capita consumption is lower than that of EXECON. To prevent social instability in POLECON, hidden trade subsidies may be

viewed by POLECON's government as a safer means, when compared to direct grants, of securing political allegiance and/or military benefits from EXECON.

We are dealing with non-market benefits because market exchange for these benefits would sometimes be considered (ethically) unacceptable. Public auctions of "country votes" in international forums are non-existent, non-aggression pacts do not appear on the open market (what would one be worth?), and populations do not readily exchange religious or ideological beliefs for material handouts. Yet we have just argued in the previous section that governments sometimes form associations to secure such non-market benefits. Therefore, the second reason to secure the above-mentioned non-market benefits through a covert payment system, such as preferential trade treatment, is that the preferences of governments differ frequently from the preferences of populations. Since a government makes decisions, yet it does not wish to alienate its population, a government may wish to conceal both the nature and the payment procedure of certain bilateral agreements. For the issues under discussion here, the most important differences in preferences between governments and populations are likely to be caused by differences in the extent to which self-esteem, pride, cultural heritage, ethnic background and other non-economic values enter into the respective utility calculations.

The third reason to employ a less explicit way to generate non-market benefits is that government officials are not held accountable for actions about which the populations does not know. This consideration may be particularly relevant here because it is difficult to assign a monetary value to the non-market benefits under discussion.

A final point against the use of direct grants is related to the public good aspects of defense. A country's military command may not have to increase its size to offer protection or deterrence to a neighboring country. Nonetheless, the neighboring country may wish to donate a cost share for those services in order to strengthen the other country's willingness to maintain such a defense structure. However, in a democratic country it probably would be very difficult to persuade legislators to support a system of direct grants to a militarily powerful ally for what appears to be a public good, especially since the benefits of the public good are conditional upon a spectrum of possible future events.¹⁰ Legislators or other decisionmakers may believe that voters are unable to appreciate fully the range of possible future states of the world, and thus also unable to understand the insurance-like benefits of the externality.

Before discussing the ways by which POLECON may generate unconventional gains from trade, some qualifications concerning the scope of our analysis are necessary. For simplicity, we model, in Section V, one type of behavior POLECON may exhibit, namely the maximization of conventional gains from trade subject to a constraint which is influenced by unconventional gains from trade. Moreover, we assume the existence of two sets of terms of trade, but do not explain how these terms of trade are generated. The more favorable terms from POLECON's point of view may be considered to be the world market terms of trade. The less favorable terms of trade may be agreed upon in a bilateral bargaining process, but we exclude this topic here despite its importance.¹¹ The

overall process of generating unconventional gains from trade is often a two-stage procedure. The first stage refers to the determination of the size of per unit export and import subsidies.¹² The second stage, which we examine, refers to the trade pattern POLECON would choose given the already determined export and import subsidies.

To generate unconventional gains from trade, POLECON could sell her exports to another country or trade region at a price below the prevailing price for an identical commodity traded on the world market. In an economy that is centrally planned or at least in which the government exercises direct control over foreign trade, it would be relatively easy to create a system of two-tier export prices. The lower tier prices would be charged to "friendly" countries and the upper tier prices, which are equal to prevailing world market prices, would be charged to the rest of the world. Exports may still be sold to friendly countries at a profit, i.e., above the domestic cost of production, but below the maximum profit that could be earned otherwise. Alternatively, exports could possibly be even further subsidized if they are sold below the domestic cost of production. Typically the amount of exports sold at the lower price is limited, at most, to an amount which is utilized domestically by the recipient country in order to prevent re-export to the rest of the world, thus eliminating the opportunity for the recipient country to earn windfall profits via arbitrage.

Variations on this scheme include the practice of sending exports to friendly countries at world market prices for payment in non-convertible (and therefore probably overvalued) currencies, and the practice of straight barter of commodities while the prevailing international

terms of trade are supposedly observed. In both cases, however, the import options of the exporting country are constrained and the "value" of export earnings for POLECON is likely to be below their nominal value.

In economies in which the government does not enjoy a foreign-trade monopoly, it is not possible to order a private exporter to lower the price to a friendly country. However, governments in market economies can grant preferential credit terms to a friendly importing country through a government export credit agency. It can be readily shown that if the government of the exporting country grants the friendly importing country a loan at an interest rate r_e below the prevailing market interest rate r_m with lump-sum repayment at the end of T years, the discounted "grant element" of this loan equals $1 - [(1 + r_m)/(1 + r_e)]^T$ times the loan.¹³ Then the "effective export price" is less than the nominal export price and this has more or less the same effect as the explicit two-tier pricing system mentioned above.

Similarly, governments of countries that exercise direct control over foreign trade can import commodities from friendly countries at prices above the prevailing world market prices. Again, these commodities may still be imported at prices below the domestic cost of production but at higher than the minimum necessary cost, or possibly imported at prices even above domestic cost. The quantity of these imports will again be limited by the importing country in order to prevent excessive profits on the part of the exporting country. This means of generating externalities in friendly countries generally cannot be used by governments of

market economies unless they agree to subsidize private importers and so motivate them to import from a higher cost but friendly country, or opt to enter the import business directly. In any case, the effect of import and export subsidies is symmetrical in the sense that they both worsen the terms of trade of the country providing the subsidy.

Other ways of generating unconventional gains from trade include quota allocation, preferential tariff treatment, and export permits. If import quotas for a given commodity are dispensed by the government of an importing country by methods other than auction, e.g., through administrative or legislative decision, friendly countries which export this commodity can be given larger quotas. This amounts to a form of foreign aid since otherwise these exporters would be willing to bid for the privilege of securing a quota share. In the case of tariffs, the granting of the most-favored-nation (MFN) status to a friendly country may provide access to an export market from which she previously had been excluded entirely (with prohibitive tariffs) or in which she was at a considerable commercial disadvantage by having to compete with countries holding the MFN status. The benefits of preferential tariff treatment in this case require little further comment. Finally, especially in the case of strategically sensitive commodities (those with potential military use or those embodying superior technologies), export permits may be granted to friendly countries but not to others.

IV. Two Situations Consistent with the Hypothesis of Unconventional Gains from Trade

At this point, the reader may question whether trade-related subsidies occur in large enough magnitudes to warrant our attention. Therefore, we present two examples -- one of an import subsidy and one of an export subsidy.

In the case of Soviet-Cuban trade, Soviet imports of sugar from Cuba are highly subsidized. The amount of the Soviet sugar subsidy for the period 1970-1979 is calculated in Table 1 below.¹⁴ The subsidy is computed by calculating the difference between the unit value of Soviet sugar imports from Cuba and the world market price of sugar (both measured in dollars), and then multiplying the difference in the two prices by the quantity of sugar imports. The results of calculation in Table 1 are consistent with the hypothesis that until 1975 the Soviet imports of Cuban sugar were set so as to insulate the Cuban economy from the impact of wide fluctuations in world market prices of sugar, a continuation of their role in the 1960's. Since 1976, these prices have been set so as to reward the Castro regime for the Cuban mercenary services and proxy intervention on behalf of the Soviet Union in countries such as Angola, Ethiopia, Mozambique, and Southern Yemen.¹⁵ In addition, the sugar import subsidy may be a reward to the Cuban political leaders for their willingness to promote Soviet ideology and anti-American feelings in the Third World, and provide the Soviet Union with a strategically located military base. When the nickel import subsidy, the oil export subsidy, and various forms of foreign aid are taken into account, Soviet economic assistance to Cuba in 1978 was estimated at 2.9 billion

Table 1.-Implicit Subsidy in Soviet Imports of Sugar from Cuba

Year	Imports of Sugar from Cuba (in million rubles)	Quantity of Imports (in million metric tons)	Unit Value of Imports (in dollars per metric ton)	World Market Price (in dollars per metric ton)	Subsidy (in million dollars)
1970	364.3	3,000	134.90	81.10	161.4
1971	185.6	1,500	137.50	99.20	57.4
1972	131.5	1,100	144.20	160.30	-17.7
1973	323.1	1,600	274.20	208.30	105.4
1974	610.8	1,856	434.90	653.90	-406.5
1975	1344.3	2,964	628.70	449.10	532.3
1976	1397.8	3,068	604.30	254.90	1072.0
1977	1675.3	3,652	622.20	179.00	1618.6
1978	2117.2	3,797	815.60	172.60	2441.5
1979*	1990.0	3,650	840.00	213.30	2287.5

*estimated

Source: Authors' own calculation based on the data from the USSR Foreign Trade Yearbooks, and IERD and IMF data on world market prices of sugar.

dollars, i.e., about 24 percent of Cuban GNP or 300 dollars per capita.¹⁶

Another situation suggestive of generation of unconventional gains from trade is the Soviet oil export subsidy to Eastern Europe for the period 1970-1980. Table 2 contains two time series of estimates for this subsidy, one based on the official exchange rate and one based on a derived (more realistic) exchange rate. Calculations I and II were made according to the following:

$$\text{Calculation I: } S_{it}^R = \left(P_{it}^R - (P_{wt}^\$ E_t) \right) Q_{it}$$

$$\text{Calculation II: } S_{it}^\$ = \left((P_{it}^R D_t) - P_{wt}^\$ \right) Q_{it}$$

where

S_{it}^R = implicit Soviet oil export subsidy to country i in year t evaluated at the official exchange rate and at current prices in millions of rubles,

$S_{it}^\$$ = implicit Soviet oil export subsidy to country i in year t evaluated at a derived exchange rate and at current prices in millions of dollars,

P_{it}^R = Soviet export price of one ton oil to country i measured in rubles,

$P_{wt}^\$$ = Soviet export price of one ton of oil to the Developed West measured in dollars,

E_t = official Soviet ruble-dollar exchange rate in year t (rubles per one dollar),

D_t = derived dollar-ruble exchange rate in year t (dollars per one ruble)

Table 2.-Implicit Subsidy in Soviet Exports of Crude Oil and Oil Products
(CTN 21+22) to Eastern Europe

Year	Bulga- ria	Czecho- slovakia	East Germany	Hungary	Poland	Romania	CMEA Six	CMEA Six
<u>C a l c u l a t i o n I</u>								
	(millions of current rubles)						(millions of curr. dollars at official exchange rate)	
1970	-19.0	-43.2	-14.2	-20.8	-40.4	-	-137.6	-152.9
1971	6.7	-9.1	19.3	-6.0	-10.4	-	0.5	0.6
1972	2.1	-14.3	12.7	-9.7	-14.1	-	-23.3	-28.1
1973	100.7	127.6	144.5	46.7	98.8	-	518.3	704.0
1974	531.9	709.6	654.6	290.8	516.8	-	2703.7	3572.9
1975	304.3	474.6	484.4	147.7	279.8	-	1690.8	2343.7
1976	380.7	611.9	629.2	209.7	387.9	-	2219.4	2943.8
1977	368.2	588.7	622.7	163.9	356.6	-	2100.1	2850.0
1978	180.6	386.1	396.7	31.8	117.0	-	1112.2	1627.6
1979*	506.8	868.8	879.1	241.6	492.9	-	2989.2	4558.5
1980*	1286.2	1972.6	1978.2	777.5	1428.7	n.a.	7443.2	11723.0

<u>C a l c u l a t i o n I I</u>								
(millions of current dollars at derived ruble/dollar exchange rate)								
1970	24.5	26.7	39.9	11.3	18.7	-	121.1	
1971	59.2	75.0	84.2	30.8	58.7	-	307.9	
1972	59.1	84.0	93.2	33.4	70.8	-	340.5	
1973	208.0	296.7	293.4	122.7	246.6	-	1167.4	
1974	779.7	1050.9	991.5	450.1	796.7	-	4068.9	
1975	653.8	946.7	918.6	385.8	695.1	-	3600.0	
1976	721.4	1097.2	1096.0	461.6	802.0	-	4178.2	
1977	794.9	1171.5	1196.2	459.7	887.1	-	4509.4	
1978	715.9	1113.8	1118.3	421.5	783.0	-	4152.5	
1979*	1349.6	2025.7	2027.5	847.3	1533.2	-	7783.3	
1980*	2686.7	3910.1	3902.8	1773.4	3145.8	n.a.	15418.8	

*estimated

Source: Vaňous (1980a), Table 13, p.30 (estimates for years 1979 and 1980 were revised).

Q_{it} = number of tons of oil and oil products exported
to country i in year t .

Calculation II is included in Table 2 as a way of quantifying an additional aspect of the implicit export subsidy, namely that the Soviet Union accepts payment in non-convertible rubles rather than in convertible dollars. Acceptance of non-convertible rubles adds to the implicit subsidy because the non-convertible ruble is overvalued. The correction for the extent of overvaluation is based on the effective Hungarian ruble/dollar cross-exchange rate used in the 1970's which we believe to be a more realistic estimate of the market value of the ruble.¹⁷

According to Calculation II, the cumulative Soviet implicit subsidy on export of oil and oil products to Eastern Europe during the period 1970-1980 is approximately 45.6 billion dollars, of which 30.1 billion dollars is attributable to differences in prices (at official exchange rates) and 15.5 billion dollars to additional discounts due to payment in non-convertible rubles. The country distribution of implicit subsidies is as follows: 8.0 billion dollars to Bulgaria (17.6 percent), 11.8 billion dollars each to Czechoslovakia and East Germany (25.8 percent each), 5.0 billion dollars to Hungary (11.0 percent), 9.0 billion dollars to Poland (19.8 percent), and none to Romania.

If the Soviet Union approaches the issue of unconventional gains from trade in an efficient manner, then the pattern of trade subsidization in Eastern Europe should reflect each Eastern European country's relative strategic importance and political allegiance to the Soviet Union.

Another explanatory variable is the extent to which each Eastern European country regards Soviet military and political goals as distinct from their own. Last but not least, this pattern is affected by different domestic fuel endowments among the Eastern European countries.¹⁸

The opportunity cost of the oil export subsidy to the Soviet Union has skyrocketed in 1979-1980 as a result of dramatic increases in the world market price of crude oil. In 1980, the estimated oil export subsidy to Eastern Europe (according to Calculation II) will equal 1.1 - 1.3 percent of Soviet GNP, or about 50 percent of total Soviet imports from the Developed West. For Eastern Europe, it will represent 3.0 - 3.5 percent of her GNP, or about 50 percent of her total export earnings in the dollar area. Moreover, because the Soviet Union is a net importer of relatively overpriced CMEA machinery and industrial consumer goods and a net exporter of relatively underpriced non-food raw materials and other fuels, estimates of total Soviet trade subsidies for 1970-1980 would be well above the figures reported in Table 2.

V. A Diagrammatical Exposition of Trade Policy Given the Presence of Unconventional Gains from Trade

Consider a model consisting of three countries (trade regions), POLECON, EXECON, and the Rest of the World (ROW). POLECON is an economy which realizes that she can generate unconventional gains from trade with EXECON but not with ROW. EXECON exchanges non-market military and political benefits with POLECON in return for preferential terms of trade (relative to those offered by ROW). POLECON and EXECON produce and consume two traded goods, goods A and B, and one non-traded good -- defense services, good C.

Before we begin to analyze the unconventional gains from trade, let us consider a situation when only conventional gains from trade are available to POLECON, both from EXECON and ROW. For simplicity, assume temporarily that POLECON is a small country facing two sets of constant terms of trade. In particular, POLECON faces superior terms of trade TT_I with ROW and inferior one-way terms of trade TT_{II} with EXECON. POLECON's terms of trade with EXECON are one-way terms of trade in the sense that EXECON always prefers to import good B in exchange for her exports of good A at the terms of trade TT_{II} , but never prefers to import good A in exchange for exports of good B at the terms of trade TT_{II} . This assumption is necessary in order to prevent POLECON from making infinite profit by first selling all of her production of good B to ROW at the terms of trade TT_I , then selling all her imports of good A to EXECON at the terms of trade TT_{II} and so on, with ever increasing gains from trade.

In the absence of unconventional gains from trade, POLECON will trade only with ROW. POLECON's conventional gains from trade and welfare are maximized by observing the rule $MRS_{A,B} = MRT_{A,B} = (P_B/P_A)_I = TT_I = \max(TT_I, TT_{II})$.

Let us now assume that POLECON can generate non-market military or political benefits from EXECON by trading with EXECON at the one-way preferential terms of trade $TT_{II} < TT_I$. Initially, to simplify the analysis, we will consider the presence of conventional and unconventional gains in a model of pure exchange and ignore the problem that the preferential terms of trade TT_{II} cannot be constant over the entire range of possible trade.¹⁹

Let POLECON's initial endowment of goods be represented by point E_0 in Figure 1. Assume that POLECON's endowment of goods A and B actually available for consumption or exchange with EXECON and ROW is only E_1 because POLECON has decided to use some of goods A and B to produce a target amount of good C -- defense services -- in order to insure that POLECON's endowment E_1 is secure with a given probability. The slope of the line connecting points E_0 and E_1 indicates the proportions in which goods A and B are used to produce good C domestically. For simplicity, we are assuming a Leontief-type fixed-coefficient production function for defense. Alternatively, some defense services may be acquired in the form of external military benefits available to POLECON from EXECON in exchange for preferential terms of trade relative to those offered by ROW. Let us also assume that the maximum amount of external military benefits POLECON can generate by trading with EXECON will save an amount

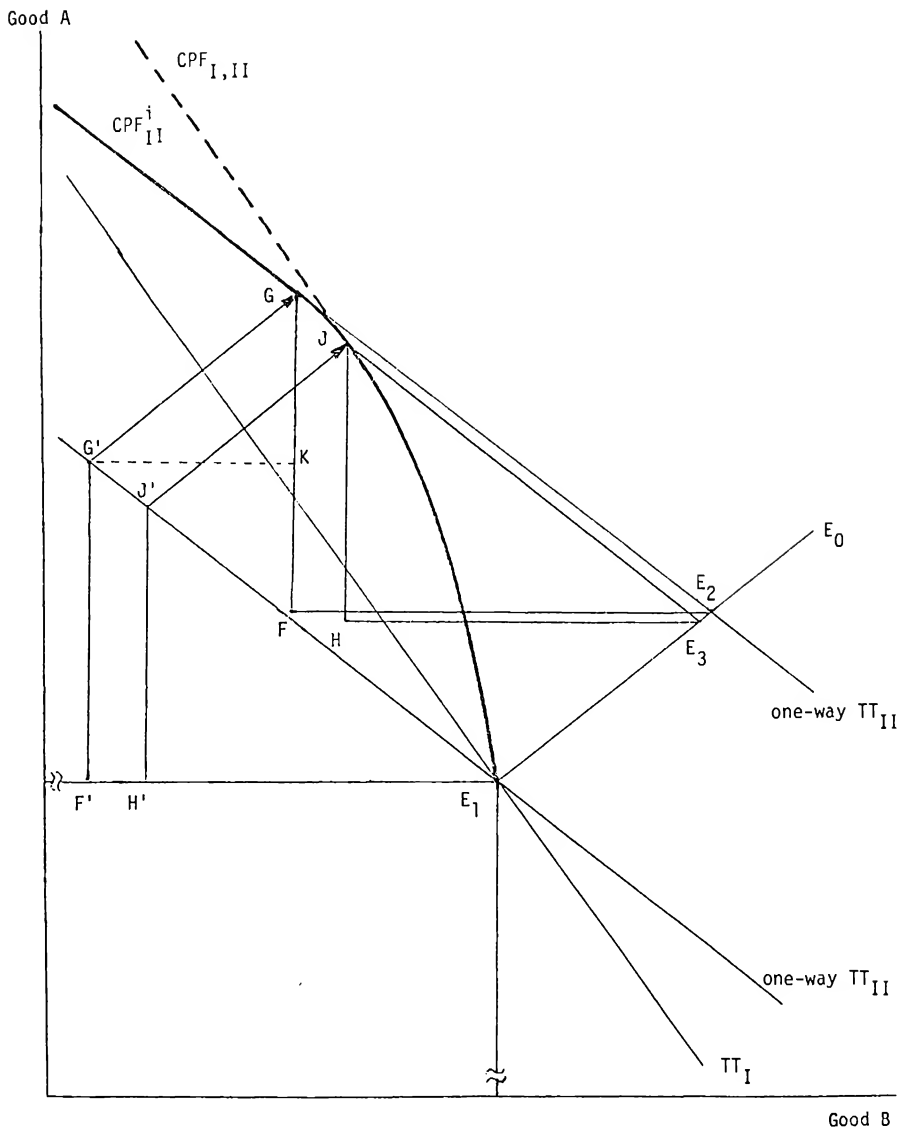


Figure 1. - Detailed Construction of the Consumption Possibility Frontier in a Model of Pure Exchange

of goods A and B so as to move POLECON from endowment point E_1 to point E_2 . In other words, POLECON will still have to produce some defense services domestically since the presence of the external military benefits cannot completely provide the target amount of defense services. Finally, we assume that the marginal value of the non-market benefits POLECON can generate in EXECON is sufficiently large for POLECON to decide to conduct at least a portion of her trade with EXECON.

Next, we will show that, given the above assumptions, POLECON's consumption possibility frontier from trade with both countries is her consumption possibility frontier from trade inclusive of external benefits with EXECON, CPF_{II}^i , between points E_1 and J, and from point J onward it is a straight line with slope TT_I . POLECON's consumption possibility frontier from trade with both countries is labeled $CPF_{I,II}$. $CPF_{I,II}$ consists of two segments because at point E_1 , the slope of CPF_{II}^i (hereafter referred to as $MBTT_{II}^i$, the marginal barter terms of trade with EXECON inclusive of external benefits) is greater than TT_I . So POLECON chooses to begin trading with EXECON and continues to direct all further trade to EXECON until the $MBTT_{II}^i$ is equal to TT_I . Notice that we are assuming diminishing marginal productivity of the trade subsidy in producing non-market benefits in EXECON. This appears in Figure 1 as a strictly concave segment of CPF_{II}^i between, say, points E_1 and G. So as POLECON increases her trade with EXECON at the terms of trade TT_{II} , $MBTT_{II}^i$ will decrease.

The locus of points on the strictly concave segment of CPF_{II}^i between points E_1 and J represents POLECON's consumption bundles when her optimal trade pattern implies trade only with EXECON. Suppose POLECON

trades $F'E_1$ of good B for $F'G'$ of good A. Then POLECON's corresponding consumption bundle is not point G' , but point G. This is due to the non-market benefits which POLECON receives from EXECON, the opportunity cost of which is a reduction in domestic defense expenditures of $G'K$ of good B and KG of good A. Notice that $G'G$ and E_1E_2 represent the same change in goods A and B, which is interpreted as a change in endowment. More generally, segment E_1E_2 , which represents POLECON's variable endowment, is constructed by plotting the non-market benefits POLECON receives for all levels of trade with EXECON.

POLECON is not at an optimum at point G because $MBTT_{II}^i < TT_I$. To reach an optimum, POLECON would have to reduce her trade with EXECON and increase her trade with ROW from zero until $MBTT_{II}^i = TT_I$ (at point J).

There are two alternative ways to explain how POLECON reaches point J. We could say that POLECON moves from E_1 to E_3 because she has decided to trade with EXECON up until $MBTT_{II}^i = TT_I$. Such a level of trade with EXECON implies a level of external military benefits that allows POLECON to decrease domestic production of C and thus save an amount of A and B, which explains the move from E_1 to E_3 . From E_3 , it is clear that POLECON trades HE_3 of good B to obtain HJ of good A, and thereby reaches point J.

Alternatively, we could say that POLECON starts trading from the endowment point E_1 and exports $H'E_1$ of good B in exchange for $H'J'$ of good A. However, at point J' POLECON has more security than the target level and reduces her domestic production of defense services, thereby moving to point J on CPF_{II}^i . Since E_3HJ and $E_1H'J'$ are

identical triangles, either way we obtain the same result. Since the benefits of further trade with EXECON are less than the costs at point J ($MBTT_{II}^I < TT_I$ after point J), POLECON will trade with ROW from point J onward.

Figure 2 below shows the conventional and unconventional gains from trade in a model with production when POLECON trades both with EXECON and ROW. If POLECON can reach the highest indifference curve U_2 by trading both with EXECON and ROW, then she should distribute her trade in such fashion so as to achieve the optimality condition $MRS_{A,B} = TT_I = MBTT_{II}^I$ (at point J) $= MRT_{A,B}$. It does not matter whether POLECON first starts trading with EXECON or ROW, either way welfare is maximized. The optimal pattern of trade for POLECON is to trade with EXECON from the endowment point P_2 along the terms-of-trade line TT_{II} up to point J, and to trade with ROW from point J to point C_2 along the terms-of-trade line TT_I . Out of total exports of P_2L of good B, P_2H will be sold to EXECON in exchange for imports of $HJ (=LK)$ of good A, and $HL = (JK)$ will be sold to ROW in exchange for imports of KC_2 of good A. Conventional gains from trade are represented by a movement from indifference curve U_0 tangent to the PPF (not shown) to indifference curve U_1 . Unconventional gains from trade due to external defense benefits generated by POLECON in EXECON are represented by a movement from point C_1 on indifference curve U_1 to point C_2 on indifference curve U_2 .

Another result obtained from Figure 2 is that except in the case when POLECON trades only with EXECON, the presence of unconventional

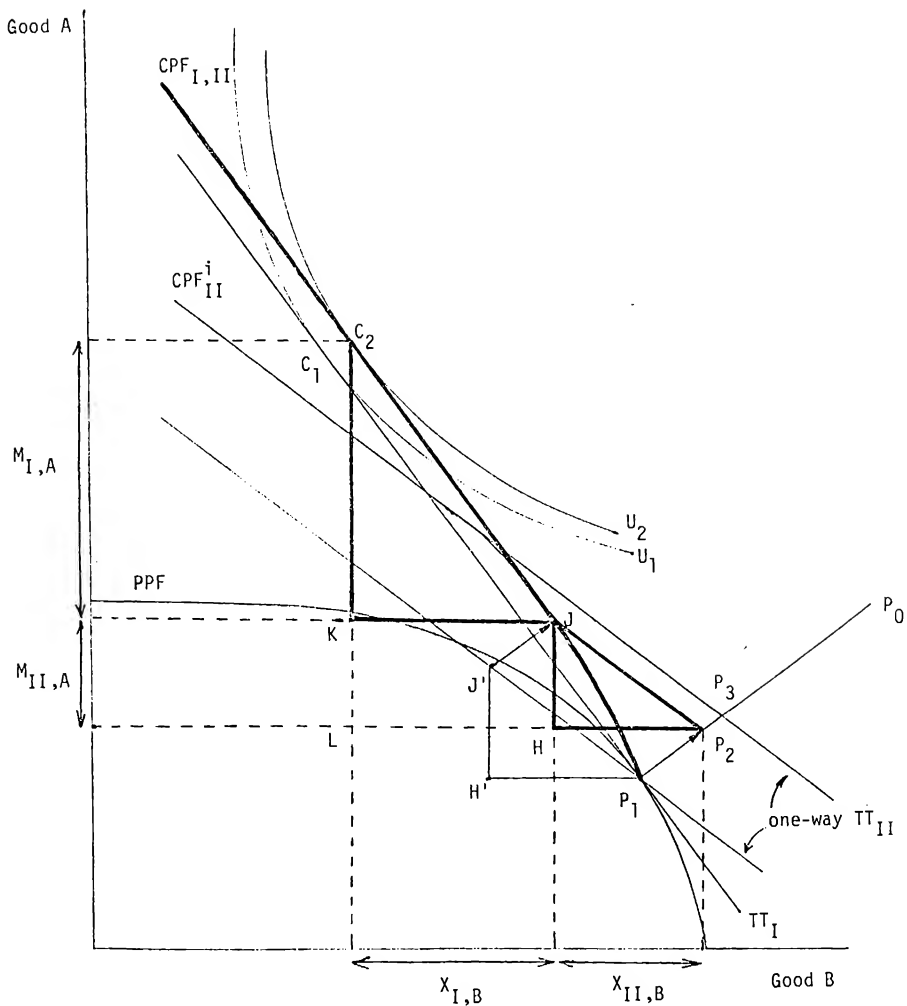


Figure 2. - Conventional and Unconventional Gains from Trade in a Model with Production when POLECON Trades both with EXECON and ROW

gains from trade will not lead to a new set of marginal conditions since the usual optimality rule $MRS_{A,B} = TT_I = MRT_{A,B}$ will still be observed.²¹ It is definitely not true that POLECON should choose to produce at a point on her PPF where $MRT_{A,B}$ equals some weighted average of either the observed or the "inclusive of external benefits" terms of trade with EXECON and ROW.

Up to now, all the analysis presented above was based on POLECON's view of the world. To conclude this section of the paper, let us look at EXECON's trade from her point of view; this is done in Figure 3 below.²² EXECON's PPF is drawn to suggest that she has comparative advantage in production of good A, while POLECON has comparative advantage in production of good B. EXECON is assumed to be a small country both relative to POLECON and ROW. In the absence of POLECON as a possible trade partner, EXECON would trade with ROW, produce at a point P_1 on her PPF and consume at point C_1 on indifference curve U_1 . The optimality condition EXECON would follow is $MRT_{A,B} = MRS_{A,B} = TT_I$. If POLECON were EXECON's only possible trade partner, EXECON facing the terms of trade TT_{II} with POLECON would desire to produce at point P_2 and consume at point C_2 on indifference curve U_2 , following the rule $MRT_{A,B} = MRS_{A,B} = TT_{II}$.

Let us now assume that POLECON is initially EXECON's only trade partner and suddenly there is a possibility for EXECON to trade with ROW at terms of trade TT_I , different from her terms of trade TT_{II} with POLECON. Clearly, what EXECON's decisionmakers would desire to do is to produce at point P_2 and initially sell all EXECON's production of good A to POLECON at the terms of trade TT_{II} , thereby reaching point V on the good

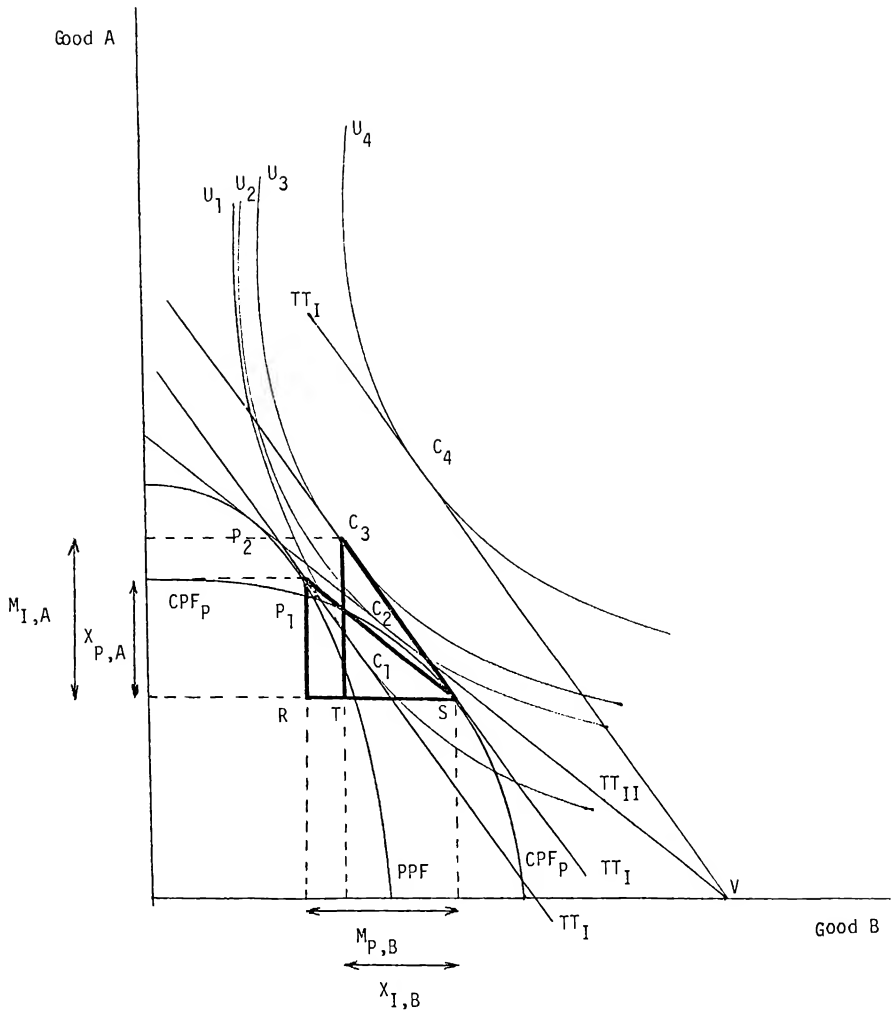


Figure 3. - EXECON's Conventional Gains from Trade with POLECON and ROW

B axis. From point V, EXECON would trade with ROW along the terms-of-trade line TT_I up to point C_4 , reaching the level of welfare represented by indifference curve U_4 . In fact, EXECON would be even better off by selling all her stock of good B to ROW in exchange for good A, and then starting to trade with POLECON again; this process could go on indefinitely and the gains from trade to EXECON would steadily increase with each round of arbitrage.

It is obvious that the above possibility would never occur in the real world because POLECON is willing to subsidize EXECON only up to a point where POLECON's marginal benefit (inclusive of non-market benefits from trade with EXECON) equals POLECON's marginal opportunity cost of this trade, which is given by POLECON's terms of trade with ROW, TT_I . Thus POLECON will fix the size of her trade triangle with EXECON and EXECON has no choice but to accept what POLECON offers. Contrary to the usual result of $2 \times 2 \times 2$ trade models in which it is the small country that determines the size of the trade triangle, in this case it is the large country that does so.

Let us now assume that POLECON's optimum trade triangle with EXECON is triangle P_2HJ (or $P_1H'J'$) from Figure 2 above. By sliding this trade triangle along EXECON's PPF with point J (or J') being the origin, we obtain EXECON's consumption possibility frontier after trade with POLECON, CPF_p . In Figure 3, the trade triangle SRP_1 is the same as trade triangles P_2HJ and $P_1H'J'$ in Figure 2. A portion of EXECON's CPF_p will lie within her PPF and is thus irrelevant from the viewpoint of EXECON's decisionmakers. Given EXECON's CPF_p , EXECON will maximize

her conventional gains from trade with ROW by observing the optimality condition $MRS_{A,B} = \text{slope of } CPF_P = TT_I$. Thus EXECON should trade with ROW from point S on CPF_P and export ST of good B in exchange for imports of TC_3 of good A. The position of point S in turn determines the position of production point P_1 . Not surprisingly, the slope of EXECON's PPF at point P_1 equals the slope of EXECON's terms of trade with ROW, TT_I . Thus the optimality condition for EXECON's trade in its entirety is $MRS_{A,B} = \text{slope of } CPF_P = MRT_{A,B} = TT_I$.

EXECON's conventional gains from trade are represented by a movement from an autarky production/consumption point C_0 on indifference curve U_0 (not shown in Figure 3) to point C_1 on indifference curve U_1 . EXECON's unconventional gains from trade in the form of a trade subsidy granted by POLECON to EXECON are represented by a movement from point C_1 on indifference curve U_1 to point C_3 on indifference curve U_3 . The situation depicted in Figure 3 actually shows EXECON re-exporting some of her imports of good B from POLECON to ROW instead of exporting good A as would happen in the absence of POLECON's preferential treatment of EXECON. Naturally, this need not be the case since EXECON may export good A both to POLECON and ROW if her indifference map has a bias in favor of consuming good B (rapidly diminishing marginal utility from consumption of good A). However, in either case, EXECON will be able to realize positive unconventional gains from trade and reach a level of welfare that could not be attained by trading with ROW alone.

VI. Extensions, the Direction of Future Research and Conclusions

Three extensions of the present model are presented in Appendices. Appendix I contains the special case of POLECON trading only with EXECON. In Appendix II, we analyze the impact of an improvement in POLECON's terms of trade with ROW. Predictably, the distribution of POLECON's trade will change in favor of ROW. In Appendix III, we relax the assumption that POLECON is a small country and find that the optimality condition becomes $MRT_{A,B} = MBTT_I = MBTT_{II}^1 = MRS_{A,B}$.

In order to use a two-dimensional diagrammatical model, the present paper examines the utility associated with the consumption of goods A and B, subject to obtaining a fixed target amount of good C. Future research, utilizing general equilibrium mathematical models, should develop the production and consumption implications for decisionmakers who seek to maximize the utility derived both from conventional and unconventional gains from trade (in this paper we were able to analyze only the former case).²³

In summary, the presence of unconventional gains from trade arises because of conflicts among the preferences of different groups in society, which motivate government officials to choose bilateral preferential trade treatment as a hidden way to generate the non-market benefits associated with bilateral agreements. One manifestation of bilateral preferential trade treatment is the existence of two sets of terms of trade. Given the two sets of terms of trade, an economy's equilibrium position will be defined relative to the terms of trade on which the marginal trade transaction was based and relative to the change in endowment due to the implicit transfer of resources.

APPENDIX I

Special Case when POLECON Trades with EXECON Only

If POLECON can reach the highest indifference curve U_2 by trading with EXECON only, as is shown in Figure 4 below, the optimality condition now becomes $MRS_{A,B} = MBTT_{II}^j$ (at point J^*) = $MRT_{A,B}$. This could happen if the POLECON preference map has a strong anti-trade bias, i.e., POLECON citizens or leaders have strong preference for consumption of good B over good A and the marginal utility of good A is rapidly diminishing. It is also more likely to happen if the externality generated by POLECON in EXECON is "large" and the marginal productivity of the implicit trade subsidy granted to EXECON by POLECON exhibits only slowly diminishing returns. Either of these two factors or both together may cause the highest indifference curve to be tangent to the CPF_{II}^j or $CPF_{I,II}$ locus between points P_1 and J in Figure 3. It is also important to note that the terms of trade with ROW are no longer relevant for POLECON's decisionmaking. Point P_1 is no longer the optimal production point; the optimal production point P_1^j must lie on POLECON's PPF to the right of point P_1 and satisfy the above-stated optimality condition.

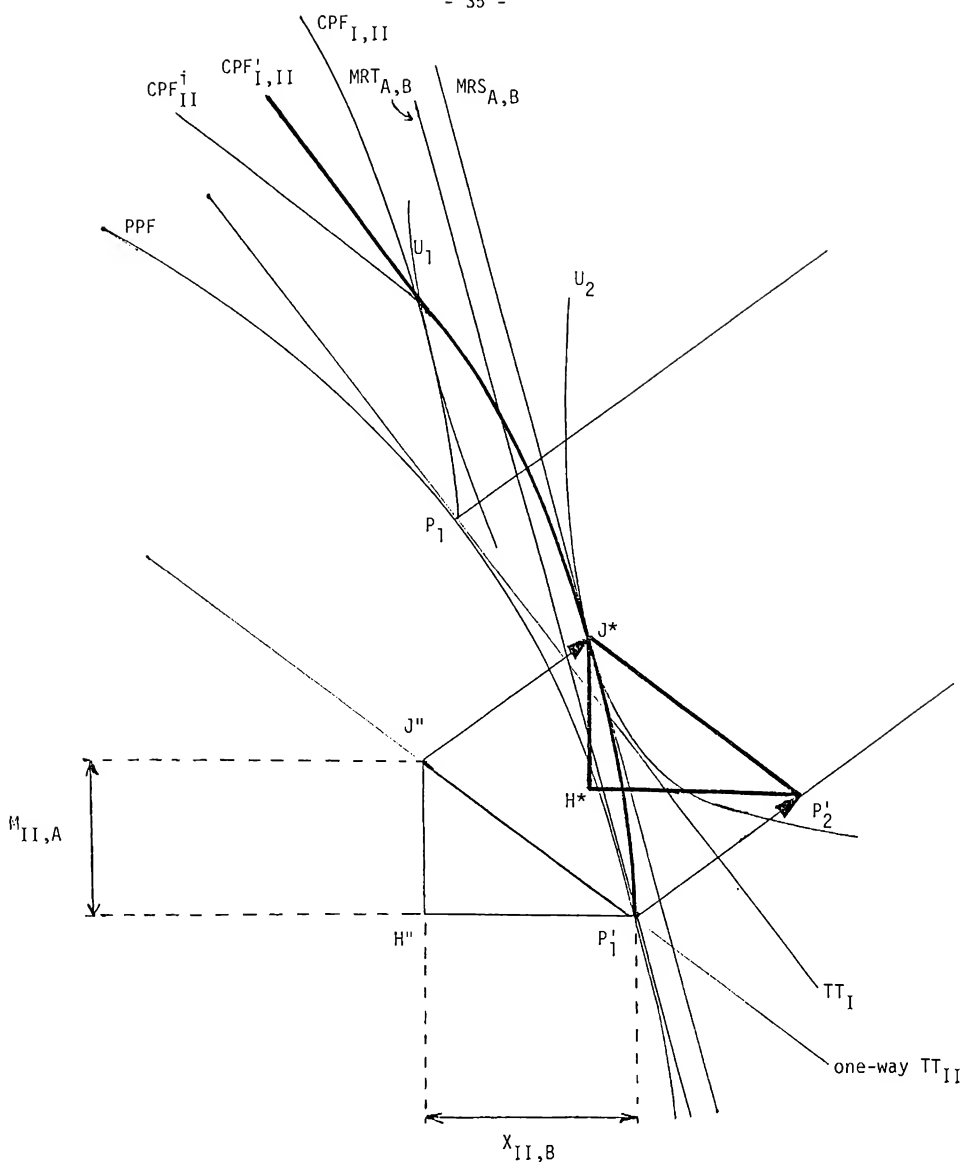


Figure 4.- Unconventional Gains from Trade in a Model with Production when POLECON Trades Only with EXECON

APPENDIX II

An Impact of An Improvement in POLECON's Terms of Trade with ROW

What happens if initially POLECON trades both with EXECON and ROW and her terms of trade with ROW suddenly improve rotating from TT_I^0 to TT_I^1 as illustrated in Figure 5 below? The improvement in the terms of trade will clearly lead to a reallocation of production from point P_1 to point P'_1 , i.e., a decline in output of good A and an increase in output of good B. Consumption will move from point C_2 to point C_3 on a higher indifference curve U_3 . The amount of good B exported may either increase or decline. Imports of good A will definitely increase if good A is a normal good. The distribution of POLECON's trade will change substantially. In particular, POLECON's trade with EXECON will decline relatively and absolutely, while her trade with ROW will increase relatively and possibly absolutely.

In Figure 5, the amount of trade POLECON conducts with EXECON after her terms of trade with ROW improved, declines absolutely. In reality, the absolute decline in POLECON's trade with EXECON may not be that large because of two factors. Firstly, if we make a reasonable assumption that the external benefits generated by POLECON in EXECON are inversely proportional to the ratio $TT_{II}^1/TT_I^1 < 1$, which is now less than the original ratio TT_{II}^0/TT_I^0 , then the strictly concave portion of the CPF_{II}^i locus between points E_1 and G (see Figure 1) will rotate upward. In other words, the vertical distance between the CPF_{II}^i locus

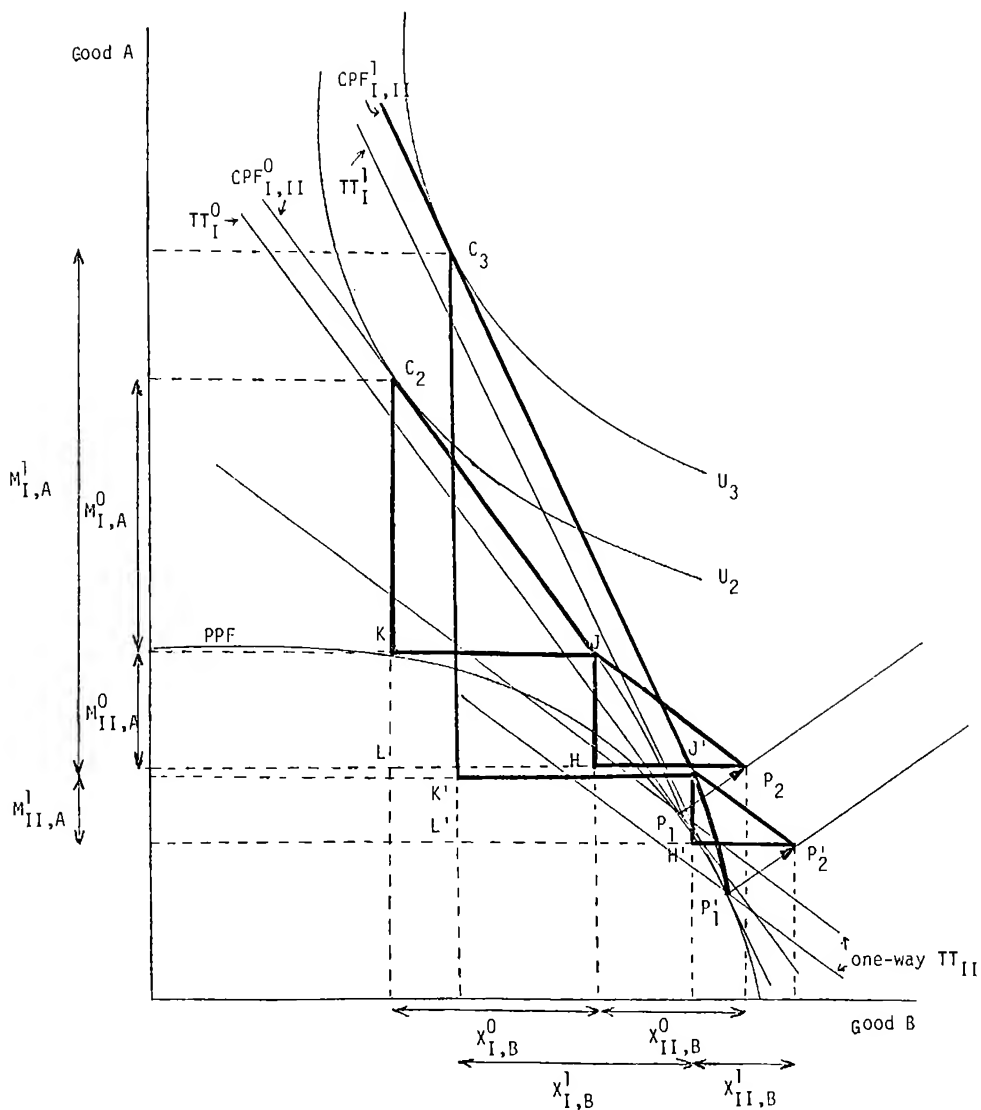


Figure 5. - Impact of an Improvement in POLECON's Terms of Trade with ROW on POLECON's Regional Structure of Trade

and one-way terms of trade with EXECON TT_{II} through point E_1 in Figure 1 will become greater since EXECON can be expected to become more grateful or allegiant for the relative increase in the implicit trade subsidy. This is one factor which will partially offset the initial incentive facing POLECON to divert her trade to ROW in response to an improvement in her terms of trade. Secondly, it may not be unreasonable to assume that there is a fixed relationship between the terms of trade offered to EXECON by POLECON and the terms of trade offered by ROW, i.e., $TT_{II}/TT_I = \beta$, $0 < \beta < 1$.²⁴ This, too, would prevent a drastic decline in EXECON's relative share of POLECON's trade.

APPENDIX III

Impact of an Assumption that POLECON is a Large Country

How are the previous results affected once we add more realism to the analysis and recognize that POLECON would typically be a large country? Thus POLECON's terms of trade with EXECON and ROW can no longer be represented by straight lines and we have to use non-linear offer curve analysis to determine the optimum amount and regional distribution of POLECON's trade. In order to demonstrate that our analysis does not depend on whether POLECON starts trading with EXECON first, in Figure 6 below, we reverse the sequence and assume that ROW becomes POLECON's first trading partner. The ROW offer curve is labeled OC_I . Let us now slide the origin of offer curve OC_I along POLECON's PPF and trace out the maximum quantity of each commodity available to POLECON for given quantities consumed (by POLECON) of the other commodity. By connecting all points so derived, we obtain POLECON's consumption possibility frontier after trade with ROW. This envelope of all achievable consumption points is the well-known Baldwin frontier and is labeled BF_I .²⁵ Next, consider the EXECON offer curves OC_I and OC_{II} , both starting from point P, it is immediately apparent that for any given amount of exports of good B by POLECON, EXECON offers a smaller amount of imports of good A than ROW. However, that is not a reason for POLECON not to trade with EXECON, unless EXECON's offer curve OC_{II} (which is still "one-sided" in the sense that EXECON insists on importing good B and exporting good A) has a slope less than POLECON's $MRT_{A,B}$ everywhere. Since this is not the case in Figure 6, we can proceed with the second stage of the analysis.

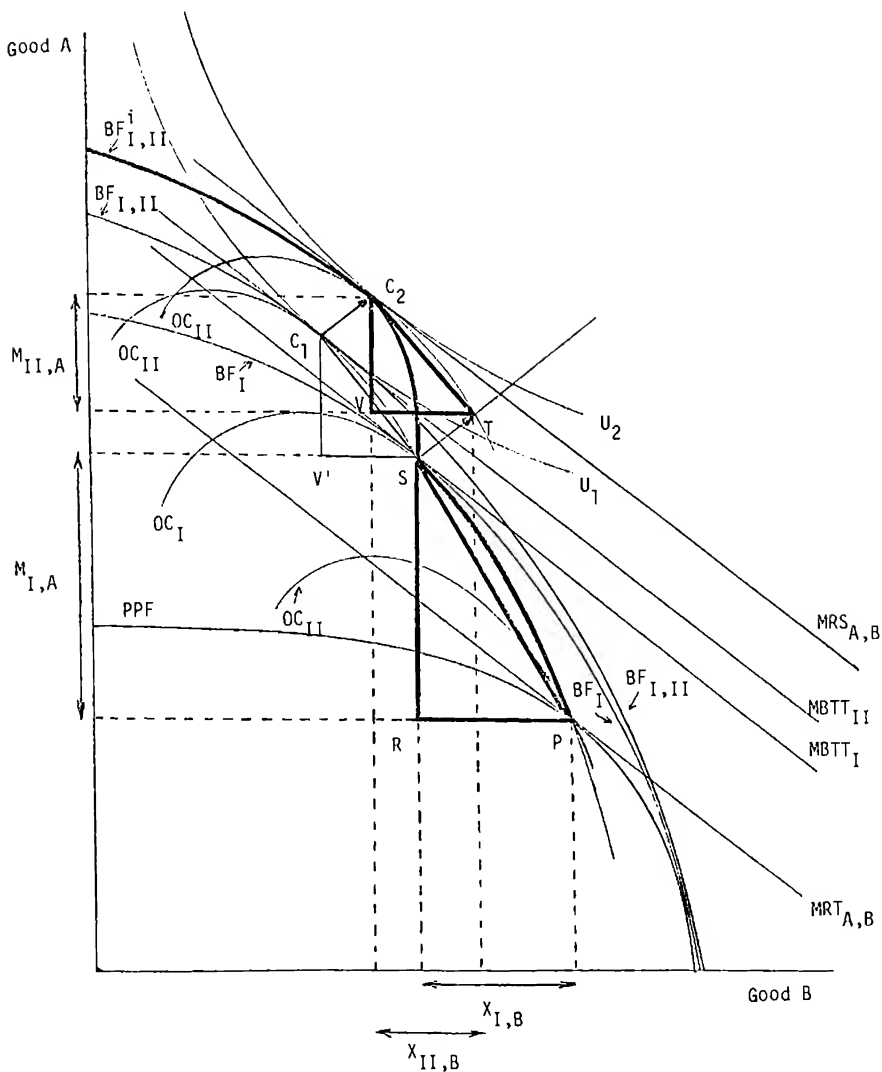


Figure 6. - Conventional and Unconventional Gains from Trade with EXECON and ROW when POLECON is a Large Country

By sliding EXECON's offer curve OC_{II} along POLECON's consumption possibility frontier after trade with ROW, BF_I , we can construct POLECON's consumption possibility frontier after trade with both countries which is labeled $BF_{I,II}$. It is readily apparent that even without taking into account the possible non-market benefits generated by POLECON in EXECON, POLECON's welfare is increased by trading with both countries, since the envelope $BF_{I,II}$ lies strictly outside envelope BF_I except at one point. In the absence of non-market benefits, the optimality condition for conducting POLECON's trade would be $MRT_{A,B} = MBTT_I = MBTT_{II} = MRS_{A,B}$, where $MBTT_I$ and $MBTT_{II}$ are POLECON's marginal barter terms of trade with ROW and EXECON, respectively, or the slopes of envelopes BF_I and $BF_{I,II}$. Thus POLECON should produce at point P on her PPF and begin trade by exporting PR of good B to ROW in exchange for imports of RS of good A, thereby reaching point S on envelope BF_I . From point S onward, POLECON should trade with EXECON and export SV' of good B in exchange for imports of V'C₁ of good A. POLECON's conventional gains from trade are represented by a movement from an autarky point on her PPF on indifference curve U_0 (not shown) to point C₁ on indifference curve U_1 .

Since POLECON's observed average terms of trade with EXECON, measured by the slope of the line SC₁, are (always) inferior to her terms of trade with ROW, measured by the slope of the line PS, trade with EXECON should generate non-market benefits for POLECON in EXECON. We can now assume that POLECON exports SV' of good B in exchange for imports of V'C₁ of good A, but she actually consumes at point C₂ because her decisionmakers realized that at point C₁ her consumption was more secure

than required, reduced her domestic production of defense, thereby saving enough of goods A and B to reach consumption point C_2 . Alternatively, we can argue that at point S, POLECON's decisionmakers realized that they could generate military benefits in EXECON, reduced domestic production of defense services, thereby moving from point S to point T. In order to generate the non-market benefits in EXECON, POLECON would then sell $TV (=SV')$ of good B to EXECON in exchange for imports of $VC_2 (=V'C_1)$ of good A. Either way, the end result is the same; POLECON realizes unconventional gains from trade represented by the movement from point C_1 on indifference curve U_1 to point C_2 on indifference curve U_2 .

An important point is that POLECON would have conducted some trade with EXECON irrespective of whether any non-market benefits can be generated or not.²⁶ Thus in this case, the external military benefits generated by POLECON in EXECON were not entirely required by POLECON. Why then would EXECON be willing to generate these benefits (which may or may not be without cost to EXECON)? One plausible story is that EXECON's leaders think that POLECON's average terms of trade with ROW (represented by line PS) are also POLECON's marginal barter terms of trade, i.e., EXECON's leaders suffer from an illusion that POLECON is a small country in world trade and faces a perfectly elastic offer curve on the part of ROW. Thus EXECON's leaders tend to think that they are receiving preferential trade treatment and supply external military benefits to POLECON in exchange for something they might be able to obtain anyway. Alternatively and possibly even more likely, POLECON's leaders point out to EXECON's leaders the difference in POLECON's average

terms of trade with EXECON and ROW and demand some external military benefits from EXECON in return for the imaginary trade subsidy. POLECON's leaders do not bother to point out that should POLECON attempt to increase exports of good B to ROW, her marginal barter terms of trade with ROW would be less than those with EXECON, thereby making trade with EXECON more attractive than additional trade with ROW.²⁷

In the presence of unconventional gains from trade with EXECON, the optimality condition for conducting POLECON's trade becomes $MRT_{A,B} = MBTT_I = MBTT_{II}^i = MRS_{A,B}$, where $MBTT_{II}^i$ are POLECON's marginal barter terms of trade with EXECON inclusive of external benefits, or the slope of the concave locus between points J and C_2 , which traces all mappings of possible points C_1 into C_2 . Point C_2 actually lies on a consumption possibility frontier inclusive of external $BF_{I,II}^i$, of which we show a portion lying between point C_2 and the A axis (bold concave curve). The difference between the optimality conditions for the case of no non-market benefits and for the case in which non-market benefits are present is that in the latter case, $MRS_{A,B}$ should equal to $MBTT_{II}$ or the slope of EXECON's offer curve starting from point T, while in the former case, $MRS_{A,B}$ should equal to $MBTT_{II}$ or the slope of EXECON's offer curve starting from point S. Thus $MRS_{A,B}$ can be different at points C_1 and C_2 (although this is not so in Figure 6 because of the shape of the indifference map). Consequently, the position of point C_1 (where indifference curve U_1 is tangent to locus $BF_{I,II}$) in the case of no non-market benefits can be different from the position of point C_1 (fixed by the position of point C_2 and the factor proportions used in POLECON's domestic production of defense) in the case when non-market benefits are present.

FOOTNOTES

¹This statement does not refer to the welfare position of Eastern European countries and it does not reflect the behavior exhibited during the 1950s. We are dealing strictly with the Soviet Union's viewpoint.

²The term two-way terms of trade implies that a given amount of good A can be exchanged for a particular amount of good B on the world market, which in turn can be exchanged again for the original amount of good A and vice versa. The term one-way terms of trade implies that a given amount of good A can be exchanged for a particular amount of good B but this amount of good B can be exchanged again only for a lower than original amount of good A or vice versa. This is illustrated in Figure 1 below when POLECON can export good B to EXECON in exchange for imports of good A at the terms of trade labeled TT_{II} , but would be able to import good A in exchange for export of good B at the terms of trade TT_I , which are less favorable from the importer's point of view than those labeled TT_{II} .

³When trade balances for different commodity categories tend to go to zero over time we feel this implies an absence of subsidization.

⁴This classification is fairly similar to the one proposed by Andrzej Korbonski [1980], who considered the political value to Soviet Union of each Eastern European country as an aggregate sum of its economic, strategic-military, "proxy," and ideological "values" (p. 5).

An alternative framework for explaining how a country with superpower aspirations can use trade policy to advance her political-economic power was developed by Albert O. Hirschman [1945] thirty-five years ago. Hirschman sees foreign trade having two principal effects upon the power position of a country with superpower aspirations. First, Hirschman defines the supply effect to include economic gains from trade that increase the economic power of the dominant country. Second, foreign trade becomes a direct source of power if other smaller countries become economically dependent on the dominant country and thus provide it with an instrument of coercion. This effect Hirschman calls the influence effect. Then the power to interrupt or redefine commercial relations with a dependent country is the root cause of the influence or power position which the dominant country acquires over other nations. The influence effect requires that the dependence of the trade partners on foreign trade must be greater than that of the dominant power. Under such circumstances, dependent countries will likely grant the dominant country certain economic, political, and military advantages in order to maintain stable trade relations. Such

dependency is enhanced to the extent that the smaller countries cannot dispense with trade with the dominant country, or replace it as a market and a source of supply. See Paul Marer [1979], pp. 27-28.

Also notice that in the case of benevolent interdependent utility functions, purely altruistic motives could lead to preferential trade treatment.

⁵An excellent example of the calculus of conventional economic benefits and costs in the case of Soviet-East European economic relations from the Soviet perspective is presented in Marer [1979] Sections A and B in the table presented on p. 9a.

⁶See Mancur Olson, Jr., and Richard Zeckhauser [1966], p. 272.

⁷For a different opinion concerning the external diseconomies of alliance formation for particular groups within a country, see Bruce M. Russett [1968], p. 65.

⁸The term "generate" refers to one country's attempt to influence the quantity of external benefits it receives by making a payment, either directly or indirectly, to the country from which the benefits come. If a country does not attempt to generate external benefits this does not imply that the external benefits will be zero.

⁹The term "purchase" is a direct means of generating an external benefit in the sense that the payment does not alter the terms of trade.

¹⁰This public good may not be a pure public good since the insurance services offered to the neighboring country may not be as complete as those offered to the domestic population and since the insurance services may depend to some degree on the cost share donated.

¹¹This bargaining process may be constrained heavily by historical considerations or agreed upon price generating rules, such as a lagged function of world market prices. We believe the bargaining process will be situation-specific. See Thomas C. Schelling [1960] for a general discussion of bilateral bargaining as a way of analyzing international interaction.

¹²Even quota rights, preferential (below market) credit arrangements for bilateral trade and preferential tariff treatment can be translated into changes in the terms of trade. Thus they, too, may be viewed as implicit export and import subsidies.

¹³The undiscounted "grant element" in one dollar worth of exports equals $(1+r_m)^T - (1+r_e)^T$. Discounted by the prevalent market rate of interest, the "grant element" becomes $[(1+r_m)^T - (1+r_e)^T]/(1+r_m)^T$ which in turn is equal to the expression above.

¹⁴A similar calculation was made earlier by Theriot and Matheson [1979], Table 4, p. 560.

¹⁵Since 1976 Soviet import prices for Cuban sugar are linked to a basket of prices for basic Soviet exports to Cuba. Moreover, the base price chosen in 1975 was \$660/metric ton, based on the all time high world market price of sugar in 1974 of \$654/metric ton. In comparison, during 1976-1979 the world market price of sugar moved in the \$170-\$255 range. See Theriot and Matheson [1979], pp. 555 and 559. For an example of Cuba engaging in proxy intervention, see Rodney Tasker [1980], p. 22, for a description of Cubans piloting MiG 21 fighters based in South Yemen and training South Yemen's 18,000 man army. Also on p. 22, Tasker comments on the clear connection between the recently signed friendship pact with the Soviet Union and South Yemen's loss of sovereignty: "The South Yemen Government probably has a more substantial relationship with Moscow than any country outside the Warsaw Pact. Under a 20 year friendship treaty signed in Moscow last October with South Yemen's president at the time, Abdul Fatah Ismail, Aden in effect surrendered a great deal of its independence and sovereignty. Almost incredibly, if reliable reports of the treaty's secret clauses are to be believed, South Yemen agreed to inform the Soviet Union of all its internal and external political proceedings, and accepted that it 'must not take any political initiative of any kind' without consulting Moscow."

¹⁶Theriot and Matheson [1979], p. 560.

¹⁷For more detail, see Vaňous [1980a], Appendix, Table 20, or Vaňous [1980b], Table 1.

¹⁸Our ranking of Eastern European countries according to each's strategic importance to the Soviet Union (from high to low) is: East Germany, Czechoslovakia, Poland, Hungary, Bulgaria and Romania. Our ranking of political allegiance to the Soviet Union (from high to low) is: Bulgaria, Czechoslovakia and East Germany in one group, followed by Poland, Hungary and Romania. Finally, our ranking of fuel endowments (from poor to rich) is: Bulgaria, Hungary, East Germany, Czechoslovakia, Romania and Poland.

¹⁹Constant preferential terms of trade TT_{II} would enable EXECON to earn "excessive" profits from arbitrage. Thus the amount of exports of good B will be constrained by POLECON so that only a certain percentage of EXECON's "needs" is satisfied.

²⁰Naturally, it is possible that EXECON will trade with POLECON only. This case is discussed below and is depicted in Figure 4 in Appendix I.

²¹As is pointed out in Appendix I, when POLECON trades only with EXECON, the optimality condition becomes $MRS_{A,B} = MBTT_{II} = MRT_{A,B}$.

²²By EXECON's point of view, we mean EXECON's preferences for goods A and B, neither of which represents sovereignty. Figure 3 refers to EXECON being confronted with "certain association" with POLECON and, in effect, some transfer of goods A and B from POLECON. Under these conditions, EXECON wants as much transfer as is available.

²³The former model is more general because it allows substitution between goods A, B, and C (defense services) in the utility function.

²⁴See Footnote 7.

²⁵See, e.g., M. Chacholiades [1978], pp. 493-494.

²⁶Naturally, in the absence of non-market benefits generated in EXECON, the amount of trade between EXECON and POLECON would decline.

²⁷If EXECON can induce POLECON to increase their mutual trade by offering external military benefits to POLECON, this would rationalize the actions of EXECON's leaders. While Figure 6 shows a case in which the presence of external military benefits available to POLECON in EXECON does not result in any change in the volume of mutual trade, a different shape of POLECON's preference map may lead to an increase in mutual trade in the presence of external military benefits.

FINAL REPORT TO
NATIONAL COUNCIL FOR SOVIET AND EAST EUROPEAN RESEARCH

TITLE: COSTS AND BENEFITS OF SOVIET TRADE
WITH EASTERN EUROPE: A THEORETICAL
AND QUANTITATIVE ANALYSIS

PART II

"OPTIMAL BEHAVIOR IN THE PRESENCE
OF UNCONVENTIONAL GAINS FROM TRADE"

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"OPTIMAL BEHAVIOR IN THE PRESENCE OF
UNCONVENTIONAL GAINS FROM TRADE"

by

Michael Marrese and Jan Vanous^V

A B S T R A C T

Unconventional gains from trade are defined as the non-market benefits of bilateral agreements which are secured through bilateral preferential trade treatment. Unconventional gains from trade arise because of conflicts among different groups in society, which motivate government officials to choose bilateral preferential trade treatment as a hidden way of generating non-market benefits. Creating bilateral terms of trade which are different from world market terms of trade has been an observable example of bilateral preferential trade treatment.

The customs union literature addresses the issue of preferential trade treatment, but focuses on welfare measured in terms of consumption of traded goods and services. Our analysis focuses on commodities which under particular social traditions and during a particular time period are not traded openly. Moreover, our analysis is applicable in either an auctioneer-type situation with many buyers and sellers or in a bilateral bargaining situation.

The purpose of this paper is to analyze the production, trade and consumption behavior of a country facing bilateral terms of trade which differ from world market terms of trade because of the presence of non-market benefits. Section 1 presents two examples in which social conflict causes the bilateral distortion of world market terms of trade. Both examples utilize three hypothetical countries: POLECON, representing a politicized economy interested in obtaining non-market benefits from EXECON; EXECON, which is a potential external source of non-market benefits for either POLECON or ROW; ROW, the rest of the world, which is also interested in obtaining non-market benefits from EXECON.

In the first example, EXECON's non-market benefits are auctioned to the highest bidder. Suppose POLECON is the highest bidder. Why doesn't POLECON send a lump-sum payment to EXECON for these on-market benefits?

Assume that a conflict exists within POLECON. Suppose POLECON's government values highly the non-market benefits from EXECON but POLECON's population does not. POLECON's government may decide to use a hidden means to purchase the non-market benefits in order to circumvent domestic conflict.

Why might POLECON decide to alter her bilateral terms of trade with EXECON? Anyone not closely associated with POLECON's government would have difficulty in determining world market prices because of the proliferation of grades and qualities of commodities and because of the paucity of detailed trade data. So POLECON could covertly pay for non-market benefits by exporting goods to EXECON at discount prices and importing goods from EXECON at premium prices. Moreover, as long as POLECON either knows, or is able to predict reasonably well, the world market prices of those commodities to which discounts or premiums are to be added, POLECON will be able to calculate the "implicit subsidy" that EXECON is receiving.

The term "implicit subsidy" refers to the payment EXECON receives from POLECON for non-market benefits. It is calculated as the value of exports less imports evaluated at world market prices minus the value evaluated at the preferential bilateral prices (assuming a standard unit of account is used through the world). Therefore, the implicit subsidy is the opportunity loss which POLECON bears by trading with EXECON at preferential bilateral prices rather than with ROW at world market prices.

This example is consistent with the analysis in section 2 as long as the increments in the bids of POLECON and ROW for an additional unit of non-market benefits increases as the quantity of non-market benefits increases.

In the second example, hegemony, defined as a situation in which one country has power superior to that of other countries, plays a crucial role. Assume POLECON has hegemony over EXECON. In the bilateral bargaining situation between POLECON and EXECON over non-market benefits, hegemony confers on POLECON three powers: (1) elimination of ROW as an alternative purchaser of non-market benefits; (2) control over the quantity of non-market benefits received; (3) some control over the amount paid to EXECON for the non-market benefits.

The first element of hegemony restricts EXECON from auctioning her non-market benefits to the highest bidder. The second allows POLECON to choose q^* , the quantity of non-market benefits to be transferred. The third refers to the set of feasible payments for q^* . POLECON will not pay more than the amount of $V_E(q^*)$ to EXECON for q^* , and EXECON will not accept less than the amount $V_E(q^*)$ from POLECON for q^* . So the bilateral bargaining problem is to choose $a(q^*)$, the actual payment for q^* , such that

$$V_E(q^*) \leq a(q^*) \leq v_E(q^*).$$

POLECON may not have the power to set $a(q^*) = v_E(q^*)$, possibly because EXECON will argue that POLECON already has imposed restrictions on EXECON by eliminating the auction process and by choosing q^* . Under a plausible set of assumptions (which includes the presence of conflict between POLECON's government and EXECON's population), we argue that as the quantity of non-market benefits increases, POLECON's incremental subsidy to EXECON for an additional unit of non-market benefits increases. In other words, there are diminishing returns to an extra unit of subsidy.

The analysis in section 2 takes place from POLECON's point of view. With a fixed endowment of inputs, POLECON produces goods A, B and C. Only A and B are traded internationally, with POLECON importing A and exporting B. In deciding on the optimal pattern of trade with ROW or EXECON or both, POLECON weighs the relative importance of two considerations. On one hand, the terms of trade offered by ROW are more favorable to POLECON than those offered by EXECON. On the other hand, non-market benefits, obtainable by exchanging B for A with EXECON at relatively disadvantageous terms of trade, act as a substitute for POLECON's domestic production of C.

Two models are presented which incorporate this tradeoff: maximization of the utility derived from both conventional and unconventional gains from trade, and maximization of conventional gains from trade subject to a constraint which is influenced by unconventional gains from trade.

The results of Models 1 and 2 indicate that whether POLECON trades with ROW or EXECON or both depends on the extent to which non-market benefits substitute for C and on POLECON's relative preference for C. When making marginal trade decisions POLECON always chooses the greater of world market terms of trade and the marginal terms of trade inclusive of EXECON's non-market benefits. Finally, POLECON's ability to secure unconventional gains from trade increases her utility, and in the case when A,B and C are normal goods, creates optimal patterns of production and consumption which include greater A and B.

OPTIMAL BEHAVIOR IN THE PRESENCE OF
UNCONVENTIONAL GAINS FROM TRADE*

by

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Unconventional gains from trade are defined as the non-market benefits of bilateral agreements which are secured through bilateral preferential trade treatment. Unconventional gains from trade arise because of conflicts among different groups in society, which motivate government officials to choose bilateral preferential trade treatment as a hidden way of generating non-market benefits. Creating bilateral terms of trade which are different from world market terms of trade has been an observable example of bilateral preferential treatment.²

The customs union literature addresses the issue of preferential trade treatment, but focuses on welfare measured in terms of the consumption of traded goods and services.³ Our analysis focuses on commodities which under particular social traditions and during a particular time period are not traded publicly. Moreover, a bilateral bargaining model often provides a better framework within which to analyze non-market benefits than does an auctioneer-type model with many buyers and sellers.

Non-market benefits of bilateral agreements may be categorized into four classes: military, political, economic and ideological.⁴ The most important type of military benefits are: (i) creation and maintenance of military alliances; (ii) absence of threat (pacification impact); (iii) availability of military bases in strategic locations; (iv) access to military technology, know-how, and training; (v) proxy intervention (availability of modern-day

international mercenaries); (vi) possibility of importing military services in the case of an internal conflict; and (vii) ability to consume another country's defense services (free-rider aspect of defense as a public good). Potential political benefits include voting along alliance lines in international forums, informal foreign government and media support, and the support and friendship of a foreign population. While most economic benefits of bilateral trade agreements are conventional in nature, several may be considered unconventional: increased economic stability, reduced risk of disrupted flow of strategic commodities, and reduced risk of refusal to purchase a country's exports for reasons other than their price-competitiveness.⁵ Possible ideological byproducts of bilateral agreements primarily occur in three areas: acceptance of a desired political ideology and its propagation to other countries; achievement of religious unity; and strengthening of ethnic solidarity.

The purpose of this paper is to analyze the production, trade and consumption behavior of two countries facing bilateral terms of trade which differ from world market terms of trade because of the presence of non-market benefits. Section 1 presents two examples in which social conflict causes the bilateral distortion of world market terms of trade. The first example involves a covert auction of non-market benefits, while the second is based on bilateral bargaining. Both examples illustrate how the amount paid for the non-market benefits might be determined. In section 2, the effects of purchasing non-market benefits via trade conducted at prices which are more favorable to the seller and less favorable to the buyer than world market prices, are studied. Two models are presented: maximization of the utility derived from both conventional and unconventional gains from trade; and maximization of conventional gains from trade subject to a constraint which is influenced by unconventional gains from trade.

Section 1: The Presence of Two Sets of Terms of Trade Due to Social Conflict

In the introduction, unconventional gains from trade are said to arise because of conflicts among the preferences of different groups in society. Two abstract examples serve to illustrate why social conflict is the reason for the existence of unconventional gains from trade.

Consider three countries: POLECON, representing a politicized economy interested in obtaining non-market benefits from EXECON; EXECON, which is a potential external source of non-market benefits for either POLECON or ROW; ROW, the rest of the world, which is also interested in obtaining non-market benefits from EXECON.

In the first example, EXECON's non-market benefits are auctioned to the highest bidder. Suppose POLECON is the highest bidder. Why doesn't POLECON send a lump-sum payment to EXECON for these non-market benefits?

Assume that a conflict exists within POLECON. Suppose POLECON's government values highly the non-market benefits from EXECON but POLECON's population does not. POLECON's government may decide to use a hidden means to purchase the non-market benefits in order to circumvent domestic conflict.

Why might POLECON decide to alter her bilateral terms of trade with EXECON? Anyone not closely associated with POLECON's government would have difficulty in determining world market prices because of the proliferation of grades and qualities of commodities and because of the paucity of detailed trade data. So POLECON could covertly pay for non-market benefits by exporting goods to EXECON at discount prices and importing goods from EXECON at premium prices. Moreover, as long as POLECON either knows, or is able to predict reasonably well, the world market prices of those commodities to which discounts or premiums are to be added, POLECON will be able to calculate the "implicit subsidy" that EXECON is receiving.

The term "implicit subsidy" refers to the payment EXECON receives from POLECON for non-market benefits. It is calculated as the value of exports less imports evaluated at world market prices minus the value evaluated at the preferential bilateral prices (assuming a standard unit of account is used throughout the world). Therefore, the implicit subsidy is the opportunity loss which POLECON bears by trading with EXECON at preferential bilateral prices rather than with ROW at world market prices.⁶

This example is consistent with the analysis in section 2 as long as the increments in the bids of POLECON and ROW for an additional unit of non-market benefits increase as the quantity of non-market benefits increases.

In the second example, hegemony, defined as a situation in which one country has power superior to that of other countries, plays a crucial role. Assume POLECON has hegemony over EXECON. In the bilateral bargaining situation between POLECON and EXECON over non-market benefits, hegemony confers on POLECON three powers: (1) elimination of ROW as an alternative purchaser of non-market benefits; (2) control over the quantity of non-market benefits received; (3) some control over the amount paid to EXECON for the non-market benefits.

The first element of hegemony restricts EXECON from auctioning her non-market benefits to the highest bidder. The second allows POLECON to choose q^* , the quantity of non-market benefits to be transferred. The third refers to the set of feasible payments for q^* . POLECON will not pay more than the amount $v_p(q^*)$ to EXECON for q^* , and EXECON will not accept less than the amount $v_E(q^*)$ from POLECON for q^* . So the bilateral bargaining problem is to choose $a(q^*)$, the actual payment for q^* , such that $v_E(q^*) \leq a(q^*) \leq v_p(q^*)$. POLECON may not have power to set $a(q^*) = v_E(q^*)$, possibly because EXECON will argue that POLECON already has imposed restrictions on EXECON by eliminating the auction process and by choosing q^* . However, POLECON's control over price can be quantified, at least

conceptually, by an index of price control $\theta(q^*)$, which is calculated as:

$$\theta(q^*) = 1 - \frac{a(q^*) - v_E(q^*)}{v_P(q^*) - v_E(q^*)}.$$

If $\theta(q^*) = 0$, then POLECON has no price control; if $\theta(q^*) = 1$, then POLECON has complete price control.

In the case in which the transfer of non-market benefits from EXECON to POLECON is advantageous or at least non-detrimental to all parties in both countries, then the solution to the bilateral bargaining problem may well be a zero payment to EXECON because EXECON does not have a viable threat position [this is certainly so if $\theta(q^*) = 1$]. However the modelling in section 2 requires that POLECON behaves as if there exists a functional relationship indicating that for an additional unit of non-market benefits, the incremental implicit subsidy increases as the quantity of non-market benefits increases.

The following assumptions provide a framework in which this functional relationship seems plausible: POLECON realizes that EXECON's population, as distinct from EXECON's government, interprets greater military and political association with POLECON as meaning less sovereignty; sovereignty is a commodity desired by EXECON's population. Even if the governments of POLECON and EXECON have the same preferences, as long as EXECON's population has a threat position that forces POLECON to pay a greater additional increment of subsidy for each additional increment of benefits, the analysis in section 2 is valid. So it is the conflict between POLECON's government and EXECON's population which causes the distortion of world market terms of trade.

Section 2: Optimal Behavior

The analysis in this section takes place from POLECON's point of view. POLECON has the option of trading with ROW or EXECON or both. ROW offers POLECON better terms of trade than EXECON (see Table 1, part 6), but we will demonstrate that it may be optimal to trade with both countries simultaneously.

With a fixed endowment of inputs, POLECON produces goods A, B and C. Only A and B are traded internationally, with POLECON importing A and exporting B at existing relative prices. However, non-market benefits obtainable by exchanging B for A with EXECON at relatively disadvantageous terms of trade, act as a substitute for POLECON's production of C.

$E(\cdot)$ (see Table 1, part 10) is a strictly concave and increasing function which maps the implicit subsidy, π , into non-market benefits, E. Thus EXECON is modelled as providing an additional increment of non-market benefits for an increment of implicit subsidy which increases as the quantity of non-market benefits increases.

The implicit subsidy, π , is the opportunity loss which POLECON bears for trading with EXECON (see Table 1, part 8).⁷ Given the balance of trade constraints with ROW and EXECON (see Table 1, part 7), π may be reduced to the value of all exports less imports evaluated at world market prices (see Table 1, part 9). So π is equal to POLECON's hypothetical balance of trade surplus that would have existed if POLECON would have conducted all of her trade at world market prices.

$D(\cdot)$ (see Table 1, part 11) captures the substitution between domestically produced C and E. D is the amount of C that yields the same level of services to POLECON as the combination $C(\bar{x}_C)$ and $E(\pi)$. So the concave and increasing function $D(\cdot)$ allows the extent to which non-market benefits act as a

Table 1: Characteristics of POLECON

- Fixed Endowment of Inputs $(\bar{x}_1, \dots, \bar{x}_N)$ where $\bar{x}_i > 0$ for $i = 1, \dots, N$
 Inputs may be used domestically to produce A, B or C. Inputs may not be traded.
 For $i = 1, \dots, N$
 x_{iA} amount of i^{th} input used to produce A
 x_{iB} amount of i^{th} input used to produce B
 $x_{iC} = \bar{x}_i - x_{iA} - x_{iB}$ amount of i^{th} input used to produce C

$$\left. \begin{array}{l} \bar{x}_i \geq x_{iA} \geq 0 \\ \bar{x}_i \geq x_{iB} \geq 0 \\ \bar{x}_i \geq x_{iC} \geq 0 \end{array} \right\} \text{Input feasibility constraints}$$
- Production functions $A(\cdot)$, $B(\cdot)$ and $C(\cdot)$ are twice differentiable, strictly concave and increasing functions of inputs. Subscripts denote partial derivatives.
 $A = A(x_{1A}, \dots, x_{NA}) \equiv A(\tilde{x}_A)$ where $A(\tilde{0}) = 0$ and $A_j(\tilde{0}) = \infty$ for some j
 $B = B(x_{1B}, \dots, x_{NB}) \equiv B(\tilde{x}_B)$ where $B(\tilde{0}) = 0$ and $B_j(\tilde{0}) = \infty$ for some j
 $C = C(x_{1C}, \dots, x_{NC}) \equiv C(\tilde{x}_C)$ where $C(\tilde{0}) = 0$ and $C_j(\tilde{0}) = \infty$ for some j
- A^0 amount of A domestically consumed
 B^0 amount of B domestically consumed
- At existing relative prices, POLECON imports A and exports B
 $- [A(\tilde{x}_A) - A^0]$ amount of A which is imported
 $[B(\tilde{x}_B) - B^0]$ amount of B which is exported
- α fraction of $- [A(\tilde{x}_A) - A^0]$ imported from ROW
 $(1-\alpha)$ fraction of $- [A(\tilde{x}_A) - A^0]$ imported from EXECON
 β fraction of $[B(\tilde{x}_B) - B^0]$ exported to ROW
 $(1-\beta)$ fraction of $[B(\tilde{x}_B) - B^0]$ exported to EXECON
- P_A trading price for A with ROW
 P_B trading price for B with ROW
 R_A trading price for A with EXECON
 R_B trading price for B with EXECON
 $P_B > R_B > 0$ and $R_A > P_A > 0$
 $A_A \equiv P_A \alpha + R_A (1-\alpha)$ average trading price for A
 $A_B \equiv P_B \beta + R_B (1-\beta)$ average trading price for B

7. POLECON's balance of trade constraints with;

$$\text{ROW} \quad P_A \alpha [\Lambda(\tilde{x}_A) - A^0] + P_B \beta [B(\tilde{x}_B) - B^0] = 0;$$

$$\text{EXECON} \quad R_A (1-\alpha) [\Lambda(\tilde{x}_A) - A^0] + R_B (1-\beta) [B(\tilde{x}_B) - B^0] = 0$$

8. π is the implicit subsidy in terms of a common international currency transferred to EXECON by POLECON.

$$\pi = (P_A - R_A)(1-\alpha) [\Lambda(\tilde{x}_A) - A^0] + (P_B - R_B)(1-\beta) [B(\tilde{x}_B) - B^0]$$

9. Given that balance of trade constraints with ROW and EXECON will always be required to hold, π may be simplified as follows:

$$\begin{aligned} \pi &= (P_A - R_A)(1-\alpha) [\Lambda(\tilde{x}_A) - A^0] + (P_B - R_B)(1-\beta) [B(\tilde{x}_B) - B^0] + \\ &\quad \{P_A \alpha [\Lambda(\tilde{x}_A) - A^0] + P_B \beta [B(\tilde{x}_B) - B^0]\} + \{R_A (1-\alpha) [\Lambda(\tilde{x}_A) - A^0] + R_B (1-\beta) [B(\tilde{x}_B) - B^0]\} \\ &= P_A [\Lambda(\tilde{x}_A) - A^0] + P_B [B(\tilde{x}_B) - B^0] \end{aligned}$$

10. E is a one-dimensional measure of the non-market benefits which POLECON receives from EXECON. $E(\cdot)$ is twice differentiable, strictly concave and increasing in π .

$$E = E(\pi) \text{ for } \pi \geq 0 \text{ where } 0 = E(0)$$

11. D is the amount of C that yields the same level of services as the combination $C(\tilde{x}_C)$ and $E(\pi)$. $D(\cdot)$ is twice differentiable, concave and increasing in both arguments.

$$D = D(C(\tilde{x}_C), E(\pi)) \text{ where } 0 = D(C(\tilde{0}), E(0)), C(\tilde{x}_C) = D(C(\tilde{x}_C), E(0))$$

substitute for domestically produced C to vary with the level of domestically produced C and the level of non-market benefits.

Assume that in the absence of unconventional gains from trade, POLECON would trade with the country which offers the more favorable terms of trade, implying that no quality or transportation differences exist.

Finally, assume that POLECON accepts both sets of terms of trade as fixed (though the analysis also holds for terms of trade represented by non-linear offer curves).⁸ This assumption ignores POLECON's role in the determination of R_A and R_B , the trading prices for A and B with EXECON. However the analysis in this section does not focus on the determination of R_A and R_B , but on POLECON's behavior once world market prices P_A and P_B , and R_A and R_B are known.

Model 1: Maximization of Conventional and Unconventional Gains from Trade

Model 1 assumes that POLECON maximizes the utility derived from conventional and unconventional gains from trade subject to production efficiency, a balance of trade constraint with each trading group and feasibility constraints. We posit a utility function, $U[\cdot]$, which is twice differentiable, strictly quasi-concave and increasing in its arguments:

$$(1) \quad U = U[A^0, B^0, D\{C(\tilde{x}_C), E(\pi)\}]; U_1[0, \cdot, \cdot] = \infty, U_2[\cdot, 0, \cdot] = \infty, U_3[\cdot, \cdot, 0] = \infty.$$

Another restriction on the utility function is that A, B and C are normal goods. So an increase in POLECON'S endowment implies increased consumption of A, B and C.

The constraint of production efficiency is embodied by defining

$$x_{iC} = \bar{x}_i - x_{iA} - x_{iB} \quad i = 1, \dots, N \text{ and by the input feasibility conditions.}$$

The balance of trade constraints have been embodied by reducing π (see Table 1) from

$$\pi = (P_A - Q_A)(1-\alpha)[A(\tilde{x}_A) - A^0] + (P_B - Q_B)(1-\beta)[B(\tilde{x}_B) - B^0] \text{ to}$$

$\pi = P_A[A(\tilde{x}_A) - A^0] + P_B[B(\tilde{x}_B) - B^0]$. Actually, this simplification requires only an overall balance of trade constraint with both groups. However only when both individual balance of trade constraints are included, are we able to solve for unique values of α and β . The unique values for α and β enable us to determine POLECON'S import and export patterns.

Let us begin by deriving the unique value for α and β . From the balance of trade constraint with ROW,

$$P_A \alpha [A(\tilde{x}_A) - A^0] + P_B \beta [B(\tilde{x}_B) - B^0] = 0 \Rightarrow \alpha = - \frac{P_B}{P_A} \frac{[B(\tilde{x}_B) - B^0]}{[A(\tilde{x}_A) - A^0]} \beta.$$

Substitute this value of α into a balance of trade constraint with EXECON,

$$R_A \left\{ 1 + \frac{P_B}{P_A} \frac{[B(\tilde{x}_B) - B^0]}{[A(\tilde{x}_A) - A^0]} \right\} \beta [A(\tilde{x}_A) - A^0] + R_B(1-\beta)[B(\tilde{x}_B) - B^0] = 0$$

$$\Rightarrow \frac{[A(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]} + \frac{P_B}{P_A} \beta + \frac{R_B}{R_A} (1-\beta) = 0$$

$$\Rightarrow \left(\frac{P_B}{P_A} - \frac{R_B}{R_A} \right) \beta = - \frac{[A(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]} - \frac{R_B}{R_A} \Rightarrow$$

$$(2) \quad \beta = \frac{\frac{[A(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]} - \frac{R_B}{R_A}}{\frac{P_B}{P_A} - \frac{R_B}{R_A}}$$

$$\text{From} \quad \alpha = - \frac{P_B}{P_A} \frac{[B(\tilde{x}_B) - B^0]}{[A(\tilde{x}_A) - A^0]} \beta \text{ and (2)} \Rightarrow$$

$$\alpha = - \frac{P_B}{P_A} \frac{[B(\tilde{x}_B) - B^0]}{[A(\tilde{x}_A) - A^0]} \left\{ \frac{\frac{[A(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]} - \frac{R_B}{R_A}}{\frac{P_B}{P_A} - \frac{R_B}{R_A}} \right\} \Rightarrow$$

$$(3) \quad \alpha = \frac{\frac{P_B}{P_A} + \frac{P_B R_B}{P_A R_A} \left\{ \frac{[B(\tilde{x}_B) - B^0]}{[A(\tilde{x}_A) - A^0]} \right\}}{\frac{P_B}{P_A} - \frac{R_B}{R_A}}$$

So once POLECON's production and consumption of A and B are determined, POLECON's exports to and imports from ROW and EXECON can be calculated by using (2) and (3) respectively.

The feasibility conditions are non-negative inputs and non-negative trade with ROW and with EXECON. Since the production functions are defined only on the non-negative quadrant, the only feasibility condition is $0 \leq \alpha \leq 1$ (if this condition is met, then $0 \leq \beta \leq 1$ because of the individual balance of trade constraints). Substituting (3) into $0 \leq \alpha \leq 1 \Rightarrow$

$$0 \leq \frac{\frac{P_B}{P_A} + \frac{P_B}{P_A} \frac{R_B}{R_A} \left\{ \frac{[B(\tilde{x}_B) - B^0]}{[A(\tilde{x}_A) - A^0]} \right\}}{\frac{P_B}{P_A} - \frac{R_B}{R_A}} \leq 1 \Rightarrow$$

$$- \frac{P_B}{P_A} \leq \frac{P_B}{P_A} \frac{R_B}{R_A} \left\{ \frac{[B(\tilde{x}_B) - B^0]}{[A(\tilde{x}_A) - A^0]} \right\} \leq - \frac{R_B}{R_A} \Rightarrow$$

$$(4) \quad \frac{R_B}{R_A} \leq - \frac{[A(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]} \leq \frac{P_B}{P_A}.$$

Hence, including constraint (4) in the model is equivalent to including the restriction of non-negative trade with ROW and with EXECON. If the right-hand weak inequality in (4) holds as an equality at the optimum, then POLECON trades only with ROW. If the left-hand weak inequality holds as an equality at the optimum, then POLECON trades only with EXECON. If (4) is a strict inequality at the optimum, then POLECON trades with ROW and EXECON.

Thus we define L by including the utility function and constraint (4) as:

$$(5) \quad L = U[A^0, B^0, D(C(\tilde{x}_C), E(\pi))]$$

$$- \lambda_1 \left\{ - \frac{P_B}{P_A} - \frac{[\Lambda(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]} \right\} - \lambda_2 \left\{ \frac{R_B}{R_A} + \frac{[\Lambda(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]} \right\}.$$

Since $U[\cdot]$ is continuous and the constraint set is compact, there exists a feasible solution which maximizes (5).⁹ Furthermore, $U[\cdot]$ is strictly quasi-concave and the constraint set is convex,¹⁰ thus the maximizer is unique.¹¹ Finally, if the Kuhn-Tucker conditions hold at a feasible point, then this feasible point maximizes (5).¹² Consequently, we wish to test the Kuhn-Tucker conditions over the set of feasible points. Using subscripts attached to functions to denote the first partial derivatives, the Kuhn-Tucker conditions with respect to A^0 , B^0 , x_{iA} , x_{iB} and the constraints are:

$$(6) \quad U_1[\cdot] - U_3[\cdot] D_2\{\cdot\} E_1(\pi) P_A + \frac{(-\lambda_1 + \lambda_2)}{[B(\tilde{x}_B) - B^0]} = 0;$$

$$(7) \quad U_2[\cdot] - U_3[\cdot] D_2\{\cdot\} E_1(\pi) P_B + (\lambda_1 - \lambda_2) \frac{[\Lambda(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]^2} = 0;$$

$$(8) \quad U_3[\cdot] \left[-D_1\{\cdot\} C_1(\tilde{x}_C) + D_2\{\cdot\} E_1(\pi) P_A A_1(\tilde{x}_A) \right] + (\lambda_1 - \lambda_2) \frac{A_1(\tilde{x}_A)}{[B(\tilde{x}_B) - B^0]} = 0;$$

$$(9) \quad U_3[\cdot] [-D_1\{\cdot\} C_1(\tilde{x}_C) + D_2\{\cdot\} E_1(\pi) P_B B_1(\tilde{x}_B)] + (-\lambda_1 + \lambda_2) \frac{[\Lambda(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]^2} B_1(\tilde{x}_B) = 0;$$

$$(10) \quad \lambda_1 \left[- \frac{P_B}{P_A} - \frac{[\Lambda(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]} \right] = 0;$$

$$(11) \quad \lambda_2 \left[\frac{R_B}{R_A} + \frac{[\Lambda(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]} \right] = 0;$$

$$(12) \quad \lambda_1 \geq 0;$$

$$(13) \quad \lambda_2 \geq 0.$$

We will divide our analysis of the Kuhn-Tucker conditions into three cases which depend on whether the constraints are binding. Case 1 indicates that POLECON only trades with ROW. This implies that constraint 1 is binding, $\lambda_2 = 0$, $\pi = 0$, $E(0) = 0$, $\alpha = \beta = 1$. The solution to case 1 is equivalent to the solution that POLECON would choose in the absence of unconventional gains from trade. Let us denote the solution to case 1 with the superscript "+".

$$(6) \Rightarrow U_1[\cdot] - U_3[\cdot] D_2(\cdot) E_1(0) P_A - \frac{\lambda_1}{[B(\tilde{x}_B^+) - B^{0+}]} = 0 \Rightarrow$$

$$(14) \lambda_1 = [U_1[\cdot] - U_3[\cdot] D_2(\cdot) E_1(0) P_A] [B(\tilde{x}_B^+) - B^{0+}]. \quad (7) \text{ and } (10) \Rightarrow$$

$$(7) \Rightarrow U_2[\cdot] - U_3[\cdot] D_2(\cdot) E_1(0) P_B - \frac{P_B}{P_A} \frac{\lambda_1}{[B(\tilde{x}_B^+) - B^{0+}]} = 0 \Rightarrow$$

$$(15) \lambda_1 = \left[U_2[\cdot] - U_3[\cdot] D_2(\cdot) E_1(0) P_B \right] \frac{P_A}{P_B} [B(\tilde{x}_B^+) - B^{0+}].$$

$$\text{Setting } (14) = (15) \Rightarrow U_1[\cdot] - U_3[\cdot] D_2(\cdot) E_1(0) P_A = U_2[\cdot] \frac{P_A}{P_B} - U_3[\cdot] D_2(\cdot) E_1(0) P_A.$$

$$\text{Thus } (16) \quad \frac{U_2[A^{0+}, B^{0+} D(C(\tilde{x}_C^+), 0)]}{U_1[A^{0+}, B^{0+}, D(C(\tilde{x}_C^+), 0)]} = \frac{P_B}{P_A}.$$

$$(8) \Rightarrow U_3[\cdot] \left[-D_1(\cdot) C_1(\tilde{x}_C^+) + D_2(\cdot) E_1(0) P_A A_1(\tilde{x}_A^+) \right] + \frac{\lambda_1 A_1(\tilde{x}_A^+)}{[B(\tilde{x}_B^+) - B^{0+}]} = 0.$$

$$\text{Substituting } (14) \Rightarrow U_3[\cdot] \left[-D_1(\cdot) C_1(\tilde{x}_C^+) + D_2(\cdot) E_1(0) P_A A_1(\tilde{x}_A^+) \right] + U_1[\cdot] A_1(\tilde{x}_A^+) - U_3[\cdot] D_2(\cdot) E_1(0) P_A A_1(\tilde{x}_A^+) = 0 \Rightarrow (17) \frac{A_1(\tilde{x}_A^+)}{C_1(\tilde{x}_C^+)} = \frac{U_3[\cdot] D_1(\cdot)}{U_1[\cdot]}.$$

$$(9) \text{ and } (10) \Rightarrow U_3[\cdot] \left[-D_1(\cdot) C_1(\tilde{x}_C^+) + D_2(\cdot) E_1(0) P_B A_1(\tilde{x}_A^+) \right] + \frac{P_B}{P_A} \frac{\lambda_1}{[B(\tilde{x}_B^+) - B^{0+}]} = 0.$$

Substituting (15) $\Rightarrow U_3[\cdot] \left[-D_1(\cdot) C_i(\bar{x}_C^+) + D_2(\cdot) E_1(0) P_B B_i(\bar{x}_B^+) \right] + U_2[\cdot] B_i(\bar{x}_B^+) -$

$$U_3[\cdot] D_2(\cdot) E_1(0) P_B B_i(\bar{x}_B^+) = 0 \Rightarrow (18) \quad \frac{B_i(\bar{x}_B^+)}{C_i(\bar{x}_C^+)} = \frac{U_3[\cdot] D_1(\cdot)}{U_2[\cdot]}.$$

$$(17) \text{ and } (18) \Rightarrow (19) \quad \frac{A_i(\bar{x}_A^+)}{B_i(\bar{x}_B^+)} = \frac{U_2[\cdot]}{U_1[\cdot]}.$$

So at the optimum for case 1, (16) indicates that the marginal rate of substitution equals world market prices, whereas (19) says that the marginal rate of transformation in production equals the marginal rate of substitution. Thus the standard results hold for case 1.

We have not yet indicated the conditions under which $\lambda_1 \geq 0$. From (14) and (15) we know that $\lambda_1 \geq 0$ iff

$$\frac{U_1[\cdot]}{P_A} \geq U_3[\cdot] D_2(\cdot) E_1(0) \text{ and } \frac{U_2[\cdot]}{P_B} \geq U_3[\cdot] D_2(\cdot) E_1(0). \quad \text{Equality of these relations}$$

implies that $\lambda_1 = 0$, which is the limit of case 2 (trade with both countries) as α and β approach 1.

$$\lambda_1 > 0 \Leftrightarrow \frac{U_1[\cdot]}{P_A} > U_3[\cdot] D_2(\cdot) E_1(0) \text{ and } \frac{U_2[\cdot]}{P_B} > U_3[\cdot] D_2(\cdot) E_1(0). \quad \text{These inequalities}$$

indicate that no trade with EXECON occurs because the marginal cost of obtaining non-market benefits is greater than the marginal gain from non-market benefits.

Consequently the unique solution for case 1 ($\lambda_1 > 0$) is denoted by S^1 :

$$S^1 \equiv \{[\Lambda(\bar{x}_A^+), \Lambda^{0+}, B(\bar{x}_B^+), B^{0+}, C(\bar{x}_C^+), 0]: \frac{A_i(\bar{x}_A^+)}{B_i(\bar{x}_B^+)} = \frac{P_B}{P_A} = \frac{U_2[\cdot]}{U_1[\cdot]}; \frac{A_i(\bar{x}_A^+)}{C_i(\bar{x}_C^+)} = \frac{U_3[\cdot] D_1(\cdot)}{U_1[\cdot]};$$

$$\frac{U_1[\cdot]}{P_A} > U_3[\cdot] D_2(\cdot) E_1(0); \quad x_{iA}^+ \geq 0; x_{iB}^+ \geq 0; x_{iC}^+ \geq 0 \quad i = 1, \dots, N\}.$$

Case 2 refers to the instance in which POLECON trades with ROW and EXECON. We know from case 1 that POLECON does not trade with EXECON because the marginal cost of obtaining additional non-market benefits is greater than the marginal gain from additional non-market benefits. Therefore case 2 occurs iff POLECON receives more non-market benefits from EXECON for each amount of implicit subsidy (a shift in $E(\cdot)$, at least near $\pi = 0$) or there is an increase in the extent to which each quantity of non-market benefits substitutes for C (a shift in $D(\cdot)$). So let us assume that either $E(\cdot)$ or $D(\cdot)$ shifts so that at S^1 the following holds:

$$\frac{U_1[\cdot]}{P_A} < U_3[\cdot]D_2(\cdot)E_1(0) \text{ and } \frac{U_2[\cdot]}{P_B} < U_3[\cdot]D_2(\cdot)E_1(0).$$

For case 2 neither constraint is binding, which implies $\lambda_1 = 0$, $\lambda_2 = 0$, $\pi > 0$, $E(\pi) > 0$, $0 < \alpha < 1$, $0 < \beta < 1$. Let us denote the solution to case 2 with the superscript " π^* ".

$$(6) \Rightarrow U_1[\cdot] = U_3[\cdot]D_2(\cdot)E_1(\pi^*)P_A.$$

$$(7) \Rightarrow U_2[\cdot] = U_3[\cdot]D_2(\cdot)E_1(\pi^*)P_B. \text{ Thus,}$$

$$(20) \frac{U_2[\Lambda^{O^*}, B^{O^*}, D\{C(\tilde{x}_C^*), E(\pi^*)\}]}{U_1[\Lambda^{O^*}, B^{O^*}, D\{C(\tilde{x}_C^*), E(\pi^*)\}]} = \frac{P_B}{P_A} \text{ and}$$

$$(21) \frac{U_1[\cdot]}{P_A} = \frac{U_2[\cdot]}{P_B} = U_3[\cdot]D_2(\cdot)E_1(\pi^*).$$

$$(8) \Rightarrow U_3[\cdot] \left[-D_1(\cdot)C_i(\tilde{x}_C^*) + D_2(\cdot)E_1(\pi^*)P_A A_i(\tilde{x}_A^*) \right] = 0 \Rightarrow$$

$$(22) A_i(\tilde{x}_A^*) = \frac{D_1(\cdot)C_i(\tilde{x}_C^*)}{D_2(\cdot)E_1(\pi^*)P_A} = \frac{U_3[\cdot]}{U_1[\cdot]} D_1(\cdot)C_i(\tilde{x}_C^*).$$

$$(9) \Rightarrow U_3[\cdot] \left[-D_1\{\cdot\}C_1(\bar{x}_C^*) + D_2\{\cdot\}E_1(\pi^*)P_B B_1(\bar{x}_B^*) \right] = 0 \Rightarrow$$

$$(23) \quad B_1(\bar{x}_B^*) = \frac{D_1\{\cdot\}C_1(\bar{x}_C^*)}{D_2\{\cdot\}E_1(\pi^*)P_B} = \frac{U_3[\cdot]}{U_2[\cdot]} D_1\{\cdot\}C_1(\bar{x}_C^*).$$

$$(22) \quad \text{and} \quad (23) \Rightarrow (24) \quad \frac{A_1(\bar{x}_A^*)}{B_1(\bar{x}_B^*)} = \frac{P_B}{P_A}.$$

Consequently the unique solution for case 2 is denoted S^2 :

$$S^2 \equiv \{[A(\bar{x}_A^*), A^{O*}, B(\bar{x}_B^*), B^{O*}, C(\bar{x}_C^*), E(\pi^*)]: \frac{A_1(\bar{x}_A^*)}{B_1(\bar{x}_B^*)} = \frac{P_B}{P_A} = \frac{U_2[\cdot]}{U_1[\cdot]};$$

$$\frac{A_1(\bar{x}_A^*)}{C_1(\bar{x}_C^*)} = \frac{U_3[\cdot] D_1\{\cdot\}}{U_1[\cdot]} ; \quad \frac{U_1[\cdot]}{P_A} = U_3[\cdot] D_2\{\cdot\} E_1(\pi^*);$$

$$x_{1A}^* \geq 0; \quad x_{1B}^* \geq 0; \quad x_{1C}^* \geq 0 \quad i = 1, \dots, N.$$

POLECON is better off in case 2 than in case 1 because of the greater value of non-market benefits in case 2 [due to the shift in $E(\cdot)$ or $D(\cdot)$]. However according to (24) the ratio of world market prices still equals the marginal rate of transformation in production because POLECON, on the margin, trades with ROW. (22) and (23) yield another standard result: POLECON'S level of trade with EXECON and level of domestic production of C are determined so that the marginal rates of transformation in production between A and C and between B and C equal the respective marginal rates of substitution. (21) indicates that at S^2 , the marginal gain from acquiring non-market benefits equals the marginal cost.

For case 2, as compared to case 1, the minimum resource cost of consuming C has decreased due to the shift in the value of non-market benefits. This is equivalent to a non-linear decrease in the per unit cost of C (or a non-linear price decrease), so more C will be consumed due to the pure substitution effect and due to the income effect (C is a normal good). Also, more A and B are consumed because they are normal goods. Thus,

POLECON must produce more A and B for two reasons: to subsidize EXECON and to increase domestic consumption. Given POLECON's fixed endowment and the greater production of A and B, POLECON must produce less C.

Case 3 refers to the situation in which POLECON trades only with EXECON. Therefore, relative to case 2, 3 occurs if POLECON receives more non-market benefits from EXECON for each amount of implicit subsidy (a shift in $E(\cdot)$, at least near $\pi = \pi^*$) or there is an increase in the extent to which each quantity of non-market benefits substitutes for C (a shift in $D(\cdot)$). Furthermore, the shift in either $E(\cdot)$ or $D(\cdot)$ must be great enough so that at the solution for case 3 ($\lambda_2 > 0$), the marginal gain of acquiring additional non-market benefits is greater than the marginal cost. For case 3, constraint 2 is binding, which implies $\lambda_1 = 0$, $\pi > 0$, $\alpha = \beta = 0$. Let us denote the solution to case 3 with the superscript " $\prime$ ".

$$(6) \Rightarrow U_1[\cdot] - U_3[\cdot]D_2\{\cdot\}E_1(\pi')P_A + \frac{\lambda_2}{[B(\tilde{x}'_B) - B^{O'}]} = 0 \Rightarrow$$

$$(25) \lambda_2 = \{U_3[\cdot]D_2\{\cdot\}E_1(\pi')P_A - U_1[\cdot]\}[B(\tilde{x}'_B) - B^{O'}].$$

$$(7) \Rightarrow U_2[\cdot] - U_3[\cdot]D_2\{\cdot\}E_1(\pi')P_B - \lambda_2 \frac{[A(\tilde{x}'_A) - A^{O'}]}{[B(\tilde{x}'_B) - B^{O'}]^2} = 0 \Rightarrow$$

$$(26) \lambda_2 = \{U_3[\cdot]D_2\{\cdot\}E_1(\pi')P_B - U_2[\cdot]\} \frac{R_A}{R_B} [B(\tilde{x}'_B) - B^{O'}] \text{ since}$$

$$\frac{R_B}{R_A} = \frac{[A(\tilde{x}'_A) - A^{O'}]}{[B(\tilde{x}'_B) - B^{O'}]} \text{ from (11).}$$

Setting (25)=(26) $\Rightarrow$

$$U_3[\cdot]D_2\{\cdot\}E_1(\pi')P_A - U_1[\cdot] = \left[U_3[\cdot]D_2\{\cdot\}E_1(\pi')P_B - U_2[\cdot] \right] \frac{R_A}{R_B} \Rightarrow$$

$$U_3[\cdot]D_2(\cdot)E_1(\pi') = U_1[\cdot] - U_2[\cdot] \frac{R_A}{R_B} \Rightarrow$$

$$\frac{P_A - P_B \frac{R_A}{R_B}}{R_B}$$

$$(27) U_3[A^{\circ'}, B^{\circ'}, D(C(\tilde{x}_C'), E(\pi'))]D_2(\cdot)E_1(\pi') = \frac{U_1[\cdot]R_B - U_2[\cdot]R_A}{P_A R_B - P_B R_A}$$

$$(8) \Rightarrow U_3[\cdot] \left[-D_1(\cdot)C_i(\tilde{x}_C') + D_2(\cdot)E_1(\pi')P_A A_i(\tilde{x}_A') \right] - \frac{\lambda_2 A_i(\tilde{x}_A')}{[B(\tilde{x}_B') - B^{\circ'}]} = 0$$

$$\text{Substituting (25)} \Rightarrow -U_3[\cdot]D_1(\cdot)C_i(\tilde{x}_C') + U_1[\cdot]A_i(\tilde{x}_A') = 0 \Rightarrow$$

$$(28) \Rightarrow \frac{A_i(\tilde{x}_A')}{C_i(\tilde{x}_C')} = \frac{U_3[\cdot] D_1(\cdot)}{U_1[\cdot]} .$$

$$(9) \Rightarrow U_3[\cdot] \left[-D_1(\cdot)C_i(\tilde{x}_C') + D_2(\cdot)E_1(\pi')P_B B_i(\tilde{x}_B') \right] + \lambda_2 \frac{[A(\tilde{x}_A') - A^{\circ'}]}{[B(\tilde{x}_B') - B^{\circ'}]^2} B_i(\tilde{x}_B') = 0$$

$$\text{Substituting (21)} \Rightarrow -U_3[\cdot]D_1(\cdot)C_i(\tilde{x}_C') + U_2[\cdot]B_i(\tilde{x}_B') = 0 \Rightarrow$$

$$(29) \frac{B_i(\tilde{x}_B')}{C_i(\tilde{x}_C')} = \frac{U_3[\cdot] D_1(\cdot)}{U_2[\cdot]} .$$

$$(28) \text{ and } (29) \Rightarrow (30) \frac{A_i(\tilde{x}_A')}{B_i(\tilde{x}_B')} = \frac{U_2[A^{\circ'}, B^{\circ'}, D(C(\tilde{x}_C'), E(\pi'))]}{U_1[A^{\circ'}, B^{\circ'}, D(C(\tilde{x}_C'), E(\pi'))]} .$$

We have not yet indicated the conditions under which $\lambda_2 \geq 0$. From (25), we know $\lambda_2 \geq 0$ iff $U_3[\cdot] D_2(\cdot) E_1(\pi') P_A \geq U_1[\cdot]$. So at the solution for case 3 when $\lambda_2 > 0$, the marginal gain of acquiring additional non-market benefits exceeds marginal cost. Now let us examine the necessary and sufficient conditions for this to hold. To begin, we return to (27).

$$(27) \quad U_3[\cdot]D_2\{\cdot\}E_1(\pi') = \frac{U_1[\cdot]R_B - U_2[\cdot]R_A}{\frac{P_A R_B}{P_B R_A} - \frac{P_B R_A}{P_A R_B}} \Rightarrow$$

$$U_3[\cdot]D_2\{\cdot\}E_1(\pi') = U_1[\cdot]R_B \left[1 - \frac{U_2[\cdot]R_A}{U_1[\cdot]R_B} \right] \Rightarrow$$

$$\frac{P_A R_B}{P_B R_A} \left[1 - \frac{P_B R_A}{P_A R_B} \right]$$

$$(31) \quad U_3[\cdot]D_2\{\cdot\}E_1(\pi')P_A = U_1[\cdot] \left[\frac{1 - \frac{U_2[\cdot]R_A}{U_1[\cdot]R_B}}{\frac{P_B R_A}{P_A R_B}} \right] ,$$

Consequently $U_3[\cdot]D_2\{\cdot\}E_1(\pi')P_A \geq U_1[\cdot] \Leftrightarrow \left[\frac{1 - \frac{U_2[\cdot]R_A}{U_1[\cdot]R_B}}{1 - \frac{P_B R_A}{P_A R_B}} \right] \geq 1$. From (25) and (31),

$$\lambda_2 = 0 \Leftrightarrow U_3[\cdot]D_2\{\cdot\}E_1(\pi')P_A = U_1[\cdot] \Leftrightarrow \frac{U_2[\cdot]}{U_1[\cdot]} = \frac{P_B}{P_A} .$$

Case 3 with $\lambda_2 = 0$ is the limit of case 2 as α and β approach 0.

Now we must determine when $\lambda_2 > 0$. Notice that the assumption

$$\frac{P_B}{P_A} > \frac{R_B}{R_A} \Rightarrow \frac{P_B R_A}{P_A R_B} > 1 \Rightarrow 0 > 1 - \frac{P_B R_A}{P_A R_B} .$$

$$\text{Thus if } 1 - \frac{U_2[\cdot]R_A}{U_1[\cdot]R_B} > 1 \Rightarrow 1 - \frac{U_2[\cdot]R_A}{U_1[\cdot]R_B} < 1 - \frac{P_B R_A}{P_A R_B}$$

$$\Rightarrow (32) \quad \frac{U_2[\cdot]}{U_1[\cdot]} > \frac{P_B}{P_A} \Leftrightarrow \lambda_2 > 0.$$

In (32), $\frac{U_2[\cdot]}{U_1[\cdot]}$ may be interpreted as the marginal terms of trade with EXECON

inclusive of the non-market benefits. So POLECON does not trade with ROW because the marginal terms of trade with EXECON inclusive of the non-market benefits are greater than world market terms of trade.

Therefore the unique solution for case 3 with $\lambda_2 > 0$ is denoted as S^3 :

$$S^3 \equiv \{[A(\tilde{x}'_A), A^{O'}, B(\tilde{x}'_B), B^{O'}, C(\tilde{x}'_C), E(\pi')]: \frac{A_1(\tilde{x}'_A)}{B_1(\tilde{x}'_B)} = \frac{U_2[\cdot]}{U_1[\cdot]} > \frac{P_B}{P_A};$$

$$\frac{A_1(\tilde{x}'_A)}{C_1(\tilde{x}'_C)} = \frac{U_3[\cdot]D_1[\cdot]}{U_1[\cdot]}; U_3[\cdot]D_2[\cdot]E_1(\pi') = \frac{U_1[\cdot]R_B - U_2[\cdot]R_A}{P_A R_B - P_B R_A};$$

$$x'_{iA} \geq 0; x'_{iB} \geq 0; x'_{iC} \geq 0 \quad i = 1, \dots, N\}.$$

For case 3 as compared to case 2, the minimum resource cost of consuming C has decreased due to the shift in the value of non-market benefits. This is equivalent to a non-linear decrease in the per unit cost of C (or a non-linear price decrease), so more C will be consumed due to the pure substitution effect and due to the income effect (C is a normal good). Also, more A and B will be consumed because they are normal goods. Thus POLECON must produce more A and B for two reasons: to subsidize EXECON and to increase domestic consumption. Given POLECON's fixed endowment and the greater production of A and B, POLECON

must produce less C.

Adding these results to those previously discussed, we find that:

$$(33) \quad A(\tilde{x}_A^{\prime}) > A(\tilde{x}_A^*) > A(\tilde{x}_A^+); \quad B(\tilde{x}_B^{\prime}) > B(\tilde{x}_B^*) > B(\tilde{x}_B^+);$$

$$C(\tilde{x}_C^{\prime}) < C(\tilde{x}_C^*) < C(\tilde{x}_C^+); \quad A^{o\prime} > A^{o*} > A^{o+}; \quad B^{o\prime} > B^{o*} > B^{o+};$$

$$D\{C(\tilde{x}_C^{\prime}), E(\pi^{\prime})\} > D\{C(\tilde{x}_C^*), E(\pi^*)\} > D\{C(\tilde{x}_C^+), E(0)\};$$

$$U[A^{o\prime}, B^{o\prime}, D\{\cdot\}] > U[A^{o*}, B^{o*}, D\{\cdot\}] > U[A^{o+}, B^{o+}, D\{\cdot\}].$$

Another comparison focuses on the marginal gain from acquiring non-market benefits evaluated at S^1, S^2 and S^3 . At S^1 , it is less than the marginal cost, whereas at S^2 and S^3 it is equal to the marginal cost. However, while the marginal gain is expressed by the same functional form in cases 1, 2 and 3, the expression for marginal cost is

$$\frac{U_1[\cdot]}{P_A} \left[\frac{1 - \frac{U_2[\cdot]}{U_1[\cdot]} \frac{R_A}{R_B}}{1 - \frac{P_B}{P_A} \frac{R_A}{R_B}} \right]$$

for case 3 and $\frac{U_1[\cdot]}{P_A}$ for cases 1 and 2. The expression for marginal cost in cases 1 and 2 is the normalized utility loss of not consuming A. In case 3, the expression for marginal cost is the normalized utility loss of not consuming A multiplied by a factor which adjusts for the implicit subsidy to EXECON.

Finally, at S^3 the marginal rate of transformation in production equals

$$\frac{U_2[\cdot]}{U_1[\cdot]} \quad \text{but not } \frac{P_B}{P_A} \quad \text{as at } S^1 \text{ and } S^2.$$

Model 2: Maximization of Conventional Gains from Trade Given the Existence of Unconventional Gains from Trade

Model 2 assumes that decisionmakers wish to maximize the utility derived from conventional gains from trade subject to maintenance of a target level of D , production efficiency, a balance of trade constraint with each country and feasibility conditions.

Under Model 2, the objective function of decisionmakers, $V[\cdot]$, is twice differentiable, strictly quasi-concave and increasing in A^0 and B^0 :

$$(34) \quad V = V[A^0, B^0].$$

The maintenance of a target level of $D, \hat{D}$, is expressed as:

$$(35) \quad \hat{D} = D\{C(\tilde{x}_C), E(\pi)\}.$$

All other constraints are embodied in the same manner as in Model 1.

Now let us define L as:

$$(36) \quad L = V[A^0, B^0] + \lambda_0 [D\{C(\tilde{x}_C), E(\pi)\} - \hat{D}] \\ - \lambda_1 \left\{ -\frac{P_B}{P_A} - \frac{[A(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]} \right\} - \lambda_2 \left\{ \frac{R_B}{R_A} + \frac{[A(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]} \right\}.$$

Just as for Model 1, if the Kuhn-Tucker conditions for Model 2 hold at a feasible point, then the feasible point is a unique maximum. The Kuhn-Tucker conditions are:

$$(37) \quad V_1[\cdot] - \lambda_0 D_2\{\cdot\} E_1(\pi) P_A + \frac{(-\lambda_1 + \lambda_2)}{[B(\tilde{x}_B) - B^0]} = 0;$$

$$(38) \quad V_2[\cdot] - \lambda_0 D_2\{\cdot\} E_1(\pi) P_B + (\lambda_1 - \lambda_2) \frac{[A(\tilde{x}_A) - A^0]}{[B(\tilde{x}_B) - B^0]^2} = 0;$$

$$(39) \quad \lambda_0 [-D_1\{\cdot\} C_1(\tilde{x}_C) + D_2\{\cdot\} E_1(\pi) P_A A_1(\tilde{x}_A)] + (\lambda_1 - \lambda_2) \frac{A_1(\tilde{x}_A)}{[B(\tilde{x}_B) - B^0]} = 0;$$

$$(40) \lambda_0 [-D_1\{\cdot\}C_1(\bar{x}_C) + D_2\{\cdot\}E_1(\pi)P_B B_1(\bar{x}_B)] + (-\lambda_1 + \lambda_2) \frac{[A(\bar{x}_A) - A^0]}{[B(\bar{x}_B) - B^0]^2} B_1(\bar{x}_B) = 0;$$

$$(41) \lambda_0 [D\{C(\bar{x}_C), E(\pi)\} - \hat{D}] = 0$$

$$(42) \lambda_1 \left[-\frac{P_B}{P_A} - \frac{[A(\bar{x}_A) - A^0]}{[B(\bar{x}_B) - B^0]} \right] = 0;$$

$$(43) \lambda_2 \left[\frac{R_B}{R_A} + \frac{[A(\bar{x}_A) - A^0]}{[B(\bar{x}_B) - B^0]} \right] = 0;$$

$$(44) \lambda_0 \geq 0;$$

$$(45) \lambda_1 \geq 0;$$

$$(46) \lambda_2 \geq 0.$$

A comparison of (37)-(40), (42), (43), (45) and (46) with (6)-(13) indicates that the two sets of equations are exactly alike except that λ_0 appears in the Model 2 set of equations instead of $U_3[\cdot]$. Furthermore, the Kuhn-Tucker conditions for Model 2 contain (41) and (44). λ_0 , the shadow price of C, is non-zero by (1), so (41) implies a smaller set of feasible production optima for Model 2 relative to Model 1. This means that the decisions in Model 2 concerning the domestic production of C are less sensitive to the full range of relative prices. This may be seen in Figures 1 and 2.

Figure 1 depicts the set of feasible production optima for Model 1 as the checkered surface in (A,B,C) space. This set is the same regardless of how POLECON evaluates the non-market benefits available from EXECON.

In order to understand Figure 2, we define the maximum amount of A, B and C that can be produced if all inputs are employed to produce one type of output good as follows:

$$A^M = A(\bar{x}, \dots, \bar{x}_N), \quad B^M = B(\bar{x}_1, \dots, \bar{x}_N) \quad \text{and} \quad C^M = C(\bar{x}_1, \dots, \bar{x}_N).$$

Next we denote as $\hat{A}$ and $\hat{B}$ the maximum amounts of A and B that can be produced, given that $\hat{D}$ is maintained solely through domestic production of C:

$$\hat{A} = \max\{A: A = A(\bar{x}_A), \hat{D} = D\{C(\bar{x}_C), 0\}, \bar{x}_A + \bar{x}_C = (\bar{x}_1, \dots, \bar{x}_N)\};$$

$$\hat{B} = \max\{B: B = B(\bar{x}_B), \hat{D} = D\{C(\bar{x}_C), 0\}, \bar{x}_B + \bar{x}_C = (\bar{x}_1, \dots, \bar{x}_N)\}.$$

Let us assume that $\hat{D} < C^M$. Immediately it is evident that the set of feasible production optima is reduced by the extent to which $\hat{D}$ is less than C^M . Figure 2's smaller checkered area (relative to that of Figure 1) depends upon the extent to which the non-market benefits received from EXECON can substitute for POLECON's production of C. Let $D\{C(\hat{D}), E(\hat{\pi})\}$ denote the upper bound on such substitution. Then the checkered area of Figure 2 is the set of feasible production optima for Model 2. If non-market benefits do not exist, then (41) restricts the set of feasible production optima to the frontier segment $S(\hat{D}) = \{[A(\bar{x}_A), B(\bar{x}_B), \hat{D}]: \hat{D} = C(\bar{x}_C) \equiv D\{C(\bar{x}_C), 0\}; \bar{x}_A + \bar{x}_B + \bar{x}_C = (\bar{x}_1, \dots, \bar{x}_N)\}$.

The similarity between Model 1 and Model 2 becomes especially apparent by expressing Model 2 as a particular form of Model 1:

$$(47) \quad U[A^0, B^0, D\{C(\bar{x}_C), E(\pi)\}] = V[A^0, B^0] + \lambda_0 [\hat{D} - D\{C(\bar{x}_C), E(\pi)\}]$$

for $A^0 \geq 0, B^0 \geq 0, \bar{x}_C \geq 0, \pi \geq 0$;

$$(48) \quad U_1[\cdot] = V_1[\cdot], U_2[\cdot] = V_2[\cdot], U_3[\cdot] = \lambda_0.$$

Hence the Kuhn-Tucker conditions for Model 2 only differ from those for Model 1 in the addition of (41) and (44). Thus the Model 2 solution sets for cases 1, 2 and 3 ($\lambda_2 > 0$), denoted by T^1, T^2 and T^3 , may be constructed directly by adding (41) to restrictions found in S^1, S^2 and S^3 and by substituting $V_1[\cdot], V_2[\cdot]$ and λ_0 everywhere that $U_1[\cdot], U_2[\cdot]$ and $U_3[\cdot]$ appear. Direct construction yields the following result where the superscript "+" denotes a case 1 solution, "*" a case 2 solution and "^" a case 3 solution:

Figure 1: Set of feasible production optima for Model 1

Set of feasible production optima is the checkered surface in (A,B,C) space. This set is the same whether or not the non-market benefits exist.

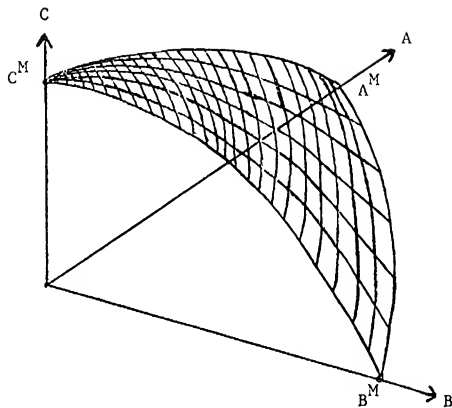
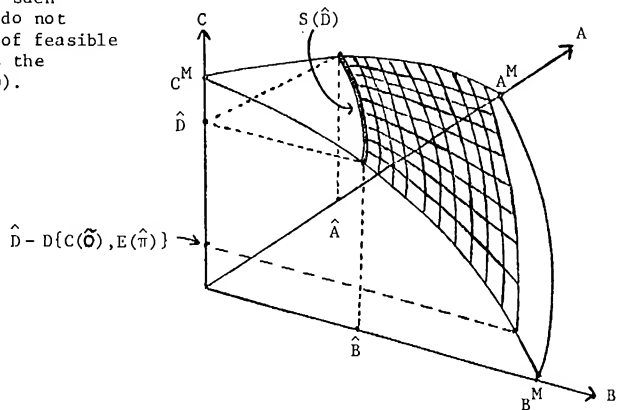


Figure 2: Set of feasible production optima for Model 2

Case when $\hat{D} < C^M$. Set of feasible production optima is the checkered surface in (A,B,C) space. This set is dependent upon the extent to which the non-market benefits can substitute for POLECON's production of C. If such non-market benefits do not exist, then the set of feasible production optima is the frontier segment $S(\hat{D})$.



$$T^1 \equiv \{ [A(\tilde{x}_A^+), A^{O^+}, B(\tilde{x}_B^+), B^{O^+}, C(\tilde{x}_C^+), 0] : \frac{A_1(\tilde{x}_A^+)}{B_1(\tilde{x}_B^+)} = \frac{P_B}{P_A} = \frac{V_2[\cdot]}{V_1[\cdot]} ; \frac{A_1(\tilde{x}_A^+)}{C_1(\tilde{x}_C^+)} = \frac{\lambda_o D_1\{\cdot\}}{V_1[\cdot]} ;$$

$$C(\tilde{x}_C^+) = \hat{D}; V_1[\cdot] > \lambda_o D_2\{\cdot\} E_1(0); x_{iA}^+ \geq 0; x_{iB}^+ \geq 0; x_{iC}^+ \geq 0 \quad i = 1, \dots, N\}.$$

$$T^2 \equiv \{ [A(\tilde{x}^*), A^{O^*}, B(\tilde{x}_B^*), B^{O^*}, C(\tilde{x}_C^*), E(\pi^*)] : \frac{A_1(\tilde{x}_A^*)}{B_1(\tilde{x}_B^*)} = \frac{P_B}{P_A} = \frac{V_2[\cdot]}{V_1[\cdot]} ;$$

$$\frac{A_1(\tilde{x}_A^*)}{C_1(\tilde{x}_C^*)} = \frac{\lambda_o D_1\{\cdot\}}{V_1[\cdot]} ; D\{C(\tilde{x}_C^*), E(\pi^*)\} = \hat{D}; \frac{V_1[\cdot]}{P_A} = \lambda_o D_2\{\cdot\} E_1(\pi^*);$$

$$x_{iA}^* \geq 0; x_{iB}^* \geq 0; x_{iC}^* \geq 0 \quad i = 1, \dots, N\}.$$

$$T^3 \equiv \{ [A(\tilde{x}_A^-), A^{O^-}, B(\tilde{x}_B^-), B^{O^-}, C(\tilde{x}_C^-), E(\pi^-)] : \frac{A_1(\tilde{x}_A^-)}{B_1(\tilde{x}_B^-)} = \frac{V_2[\cdot]}{V_1[\cdot]} > \frac{P_B}{P_A};$$

$$\frac{A_1(\tilde{x}_A^-)}{C_1(\tilde{x}_C^-)} = \frac{\lambda_o D_1\{\cdot\}}{V_1[\cdot]} ; D\{C(\tilde{x}_C^-), E(\pi^-)\} = \hat{D}; \frac{V_1[\cdot] R_B - V_2[\cdot] R_A}{P_A R_B - P_B R_A} = \lambda_o D_2\{\cdot\} E_1(\pi^-);$$

$$x_{iA}^- \geq 0; x_{iB}^- \geq 0; x_{iC}^- \geq 0 \quad i = 1, \dots, N\}.$$

Cases 1, 2 and 3 for Model 2 are distinguished by the increasing value which non-market benefits received from EXECON have for POLECON. The inequalities describing the solutions for cases 1,2 and 3 appearing in (33) hold for Model 2 as well, except that $D\{\cdot\} = \hat{D}$ for all cases.

The results of Model 2 as compared to Model 1, for identical $\frac{P_B}{P_A}, \frac{R_B}{R_A}, \tilde{x}$, $A(\cdot), B(\cdot), C(\cdot), D\{\cdot\}$, and $E(\cdot)$, exhibit differences for cases 2 and 3.

Ignoring the presence of non-market benefits, suppose Model 2's and Model 1's consumption of C is the same, namely $\hat{D} = D\{C(\tilde{x}_C), 0\}$. Now let us take into account non-market benefits of a magnitude which will produce new case 2 and case 3 solutions in both models. Each new Model 2 solution relative to its Model 1 counterpart is characterized by greater production and consumption of A and B, less production and consumption of C, and less trade with EXECON.

Section 3: Concluding Remarks

Social conflict encourages government decisionmakers to seek hidden ways to pay for the non-market benefits associated with bilateral agreements. This search has resulted in the presence of unconventional gains from trade, that is, securing these non-market benefits through bilateral preferential trade treatment. The idea that non-market benefits are purchased consciously through bilateral preferential trade treatment provides an explanation for the existence of more than one set of international terms of trade.

The results of Models 1 and 2 indicate that whether POLECON trades with ROW or EXECON or both depends on the extent to which non-market benefits substitute for C and on POLECON's relative preference for C. When making marginal trade decisions POLECON always chooses the greater of world market terms of trade and the marginal terms of trade inclusive of EXECON's non-market benefits. Finally, POLECON's ability to secure unconventional gains from trade increases her utility, and in the case when A,B and C are normal goods, creates optimal patterns of production and consumption which include greater A and B.

Footnotes

¹We are indebted for financial support to the National Council for Soviet and East European Research. We are grateful to David Donaldson, Craig Hakkio, Ronald Harstad and John Pomery for useful comments on an earlier draft, and to Martha Weidner for research assistance.

²See Marrese and Vaňous, [6] for two observable examples of government decisionmakers engaging in preferential bilateral trade in order to purchase non-market benefits.

³For literature on customs unions, see Kemp [1] and Lipsey [2].

⁴This classification is fairly similar to the one proposed by Korbonski [3] who considered the political value to Soviet Union of each Eastern European country as an aggregate sum of its economic, strategic-military, "proxy," and ideological "values" (p. 5).

An alternative framework for explaining how a country with superpower aspirations can use trade policy to advance her political-economic power was developed by Hirschman [1] thirty-five years ago. Hirschman sees foreign trade having two principal effects upon the power position of a country with superpower aspirations. First, Hirschman defines the supply effect to include economic gains from trade that increase the economic power of the dominant country. Second, foreign trade becomes a direct source of power if other smaller countries become economically dependent on the dominant country and thus provide it with an instrument of coercion. This effect Hirschman calls the influence effect. Then the power to interrupt or redefine commercial relations with a dependent country is the root cause of the influence or power position which the dominant country acquires over other nations. The influence effect requires that the dependence of the trade partners on foreign trade must be greater than that of the dominant power. Under such circumstances, dependent countries will likely grant the dominant country certain economic, political, and military advantages in order to maintain stable trade relations. Such dependency is enhanced to the extent that the smaller countries cannot dispense with trade with the dominant country, or replace it as a market and a source of supply. See Marer [5], pp. 27-28.

Also notice that in the case of benevolent interdependent utility functions, purely altruistic motives could lead to preferential trade treatment.

⁵An excellent example of the calculus of conventional economic benefits and costs in the case of Soviet-East European economic relations from the Soviet perspective is presented in Marer [5] Sections A and B of the table presented on p. 9a.

⁶Even quota rights, preferential (below market) credit arrangements for bilateral trade and preferential tariff treatment can be translated into changes in the terms of trade. Thus they, too, may be viewed as implicit export and import subsidies.

⁷ π is defined in terms of a common international currency. Naturally if trade with ROW occurred in one currency and trade with EXECON in another, exchange rate considerations would have to be incorporated in the calculation of π .

⁸We do not discuss the determination of the magnitudes of specific per unit export and import subsidies. As explained in section 1, the crucial assumption from the point of view of section 2 is that the incremental payment for an additional unit of non-market benefits increases as the quantity of non-market benefits.

⁹Varian [7, p. 258].

¹⁰The set of feasible consumption points is closed and convex due to the non-negativity constraints. The set of feasible production points is closed and bounded since it is defined on a closed set and is subject to weak inequality constraints; moreover, it is convex because the production functions are convex. Each set of feasible trades with each trading group is closed and convex because each balance of trade constraint is an equality condition. Each set of feasible trades is bounded due to the boundedness of the feasible production set. Thus, the constraint set, an intersection of the above sets, is compact and convex.

¹¹Varian [7, p. 266].

¹²Varian [7, p. 261].

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FINAL REPORT TO
NATIONAL COUNCIL FOR SOVIET AND EAST EUROPEAN RESEARCH

TITLE: COSTS AND BENEFITS OF SOVIET TRADE
WITH EASTERN EUROPE: A THEORETICAL
AND QUANTITATIVE ANALYSIS

PART III

"IMPLICIT SUBSIDIES IN SOVIET TRADE
WITH EASTERN EUROPE"

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IMPLICIT SUBSIDIES IN SOVIET TRADE WITH EASTERN EUROPE

by

Jan Vanous and Michael Marrese

A b s t r a c t

This paper presents empirical evidence on the presence of implicit Soviet trade subsidies granted to Eastern Europe in order to secure unconventional gains from trade. Unconventional gains from trade are defined as non-market benefits of bilateral agreements which are secured through preferential trade treatment. They fall into four categories: military, political, ideological, and economic. The most important types of military benefits to the Soviet Union originating in Eastern Europe have been: (i) creation and maintenance of the Warsaw Pact military alliance; (ii) existence of a safety corridor ("cordon sanitaire") between the Soviet Union and Western Europe; (iii) availability of military bases in strategic locations; (iii) proxy intervention in Third World countries on behalf of the Soviet Union. Political benefits have included voting along alliance lines in international forums, informal Eastern European government and media support, and to some extent also the support and friendship of the population of some Eastern European countries. Ideological benefits have primarily occurred through acceptance of the Soviet brand of communist political ideology and its propagation to other countries. While most economic benefits have been conventional in nature, several may be classified as unconventional: increased economic stability in CMEA, reduced risk of disrupted flow of strategic commodities (technologically superior machinery from East Germany and Czechoslovakia), and reduced risk of refusal to purchase Soviet exports for reasons other than their price-competitiveness.

In an earlier paper [Marrese and Vaňous, 1980a], the authors have presented a stylized observation about the nature of Soviet trade behavior during 1960-80, namely that:

"Within the Council for Mutual Economic Assistance, the Soviet Union has been "subsidizing" certain Eastern European countries by exporting "hard goods" (fuels, non-food raw materials, and to a lesser degree also food and raw materials for food) at prices below world market prices (wmp's) in exchange for imports of "soft goods" (machinery, equipment, industrial consumer goods) at prices above wmp's, especially if account is taken of the relatively lower quality of Eastern European manufactures in comparison with their Western counterparts."

So the authors claim that implicit Soviet trade subsidies, defined as the opportunity loss of trading at intra-CMEA prices with Eastern Europe rather than at world market prices with the Developed West, have existed during 1960-80.

Proof of the existence of implicit trade subsidies presented in this paper will hopefully enable the authors to test another proposition about the Soviet Union made in [Marrese and Vaňous, 1980a] in their future research. The authors suggested that:

"Soviet national security is produced from a combination of Soviet troops and military hardware in the Soviet Union, Soviet troops and military hardware stationed in Eastern Europe, and the allegiance of Eastern European countries."

This implies that the allegiance of Eastern European countries (aggregate of non-market benefits outlined above) can serve as a substitute for the use of

Soviet labor and capital in providing security services. Research concerning the role of East European allegiance in the production of Soviet national security would broaden our understanding of the Soviet perception of security and defense, and would strengthen our realization that Soviet defense expenditures should include Soviet outlays used to generate and sustain the allegiance of its Eastern European allies.

Implicit subsidies in Soviet trade with Eastern Europe are calculated according to the following formula:

$$\text{Subsidies} = \frac{\text{Overall Dollar Trade Balance minus Overall Ruble Trade Balance Converted into Dollars Using a "Realistic" Dollar/Ruble Exchange Rate,}}{\text{Overall Dollar Trade Balance}}$$

where

$$\text{Overall Dollar Trade Balance} = \frac{\text{Soviet Exports Valued at World Market Prices and Measured in Dollars minus Soviet Imports Valued at World Market Prices and Measured in Dollars.}}{\text{Overall Dollar Trade Balance}}$$

By world market prices (wmp's), we mean actual or hypothetical Soviet export prices to and import prices from the Developed West. By "Realistic" Dollar/Ruble Exchange Rate, which we call settlement rate, we mean the rate at which trade surpluses or deficits denominated in rubles can be eliminated by dollar payments to or from the Soviet Union.

The major contributions of the paper are presented in five separate sections (Sections V through IX) and three appendices (Appendices III through V). First, we present estimates of derived dollar/ruble exchange rates used to convert Soviet ruble trade flows into dollar trade flows priced at wmp's (Soviet East-West trade prices). Next, the results of the calculation of implicit Soviet trade subsidies to Eastern Europe are discussed in detail. In the remaining sections, we analyze the prospects for the growth of subsidies in 1979 and 1980, present evidence on the "realistic" dollar/ruble exchange rate, and finally analyze two key aspects of CMEA trade reform -- finding a realistic dollar/ruble exchange rate and correcting the distortions in the relative CMEA foreign trade price (ftp) structure vis-à-vis the wmp's. The time period covered by our study is 1960-78. Whenever appropriate, we present our findings separately for different commodity trade flows, utilizing five-commodity classification: (i) Machinery and Equipment, (ii) Fuels, (iii) Non-Food Raw Materials, (iv) Food and Raw Materials for Food, and (v) Industrial Consumer Goods.

The results of the estimation of derived dollar/ruble exchange rates indicate large differences between commodities and from year to year. Derived dollar/ruble exchange rates for Soviet exports to Eastern Europe lie between 0.39 and 3.64 dollars per one ruble; import exchange rates lie between 0.43 and 2.02 dollars per one ruble. The pattern of differences in derived dollar/ruble exchange rates across commodities conforms to the pattern expected on the basis of our knowledge of the pattern of biases in intra-CMEA relative ftp structure compared to the structure of wmp's. In the 1970's, the highest derived dollar/ruble exchange rates were obtained for Soviet exports of fuels (due to underpriced Soviet oil), followed by exports and imports of non-food raw materials, imports of fuels (mostly coal), exports of food and raw materials

for food (mostly grain), imports of food and raw materials for food (mostly manufactured foodstuffs), imports of industrial consumer goods, exports and imports of machinery and equipment, and finally exports of industrial consumer goods. As far as individual CMEA countries are concerned, the higher the share of manufactured commodities in trade (particularly machinery), the lower the derived exchange rate for all goods; the higher the share of primary commodities (particularly fuels in the 1970's), the higher the derived exchange rate. Consequently, on the (Soviet) export side, the derived exchange rate for East Germany is generally the highest, followed by that for Czechoslovakia, Bulgaria, Hungary, Poland, and Romania (which does not import any Soviet oil). On the (Soviet) import side, the derived exchange rate for Bulgaria is the highest, followed by that for Romania, the Czechoslovak rate together with that for East Germany and Poland being virtually indistinguishable, while the Hungarian rate generally appears to be the lowest.

By dividing the official Soviet dollar/ruble exchange rate by the estimates of derived dollar/ruble rates for Soviet exports to and imports from the CMEA Six, we obtain information on the relationship between the price level in Soviet trade with CMEA relative to the wmp level for every commodity category separately for exports and imports. Our findings support earlier conclusions by other writers that prices of primary commodities in intra-CMEA trade have historically been much closer to wmp's than prices of manufactured commodities. However, our estimates of the degree of positive deviation of intra-CMEA ftp's of manufactured commodities vis-à-vis the wmp's greatly exceed those of other writers because in our study we attempted to take into account the differences in the quality of manufactured commodities produced within CMEA and in the Developed West.

The results of the calculation of the size of implicit Soviet trade subsidies to Eastern Europe indicate large variation in their magnitude over time. The subsidies, measured in current dollars, reached their lowest level in 1963 -- 96 million dollars -- and their highest level in 1974 -- 6265 million dollars. Five different phases in the level of subsidies can be recognized. During the first phase (1960-64), between intra-CMEA ftp revisions of 1957-58 and 1964-65, these subsidies averaged about 186 million dollars annually. During the second phase (1965-69), after the 1964-65 intra-CMEA ftp revision took place, the subsidies averaged about 474 million dollars annually due to the deterioration in the Soviet terms of trade with Eastern Europe vis-à-vis the trends in relative wmp's. As a result of the temporary surge in wmp's of primary commodities in 1970-71, the average level of implicit subsidies reached about 975 million dollars annually during the third phase (1970-71). In 1972 and probably throughout most of 1973 these subsidies were in the 600 to 800 million dollar range; thus during the fourth phase (1972-73), the subsidies were close to the trend line observed during the period 1965-69. The rapid growth of wmp's of fuels in late 1973 and in 1974 pushed the level of subsidies to about 1628 million dollars in 1973 and to an annual average level of about 5776 million dollars during the fifth phase (1974-78).

While the trend in implicit Soviet trade subsidies to the CMEA Six taken together is not that surprising, the distribution of these subsidies among individual Eastern European countries appears startling in several respects. First of all, we find that in the case of Bulgaria during 1960-69 and 1971-72, and in the case of Romania during 1960-69, the implicit subsidies were negative, i.e., Bulgaria and Romania paid implicit trade taxes to the Soviet Union. During the entire 1960-78 period, the following absolute amounts of subsidies

in constant 1970 dollars were distributed to individual CMEA countries: East Germany -- 8748 million dollars, Czechoslovakia -- 4426, Poland -- 3755, Hungary -- 2891, Bulgaria -- 1671, and Romania -- net implicit taxes of 145 million dollars. Individual country shares in percentage terms during the above period amounted to: East Germany -- 41 percent, Czechoslovakia -- 21 percent, Poland -- 17 percent, Hungary -- 14 percent, Bulgaria -- 8 percent, Romania -- minus 1 percent. However, if we only look at the post-1974 period, we find that the share of Bulgaria recently increased to about 17 percent, while the share of East Germany declined to 32 percent, with the remaining shares largely unaffected.

Since the above comparisons do not take into account the size of individual CMEA countries, the ranking of countries presented above does not necessarily indicate the degree of relative strategic importance attached to them by the Soviet Union. Employing the 1970 population of each country as a proxy for size, the estimates of per capita average annual subsidies in 1970 dollars during 1974-78 turn out to be the highest for Bulgaria (58 dollars per person a year), followed by East Germany (54 dollars), Czechoslovakia (40 dollars), Hungary (34 dollars), Poland (15 dollars), and Romania (1 dollar). The dramatic rise in Soviet subsidies over time is especially apparent from the data for the CMEA Six taken together. While during 1960-64 the subsidies amounted to about 2 dollars a year per person in Eastern Europe, during 1965-69 this amount increased to almost 5 dollars, it reached 9 dollars during 1970-73, and then tripled again, reaching almost 28 dollars per person a year during 1974-78.

Another indicator of the rapid growth of implicit Soviet trade subsidies in relative terms is the growth in the ratio of the subsidies to individual CMEA countries to total Soviet exports to these countries. While this ratio was about 8 percent in the early 1960's, by 1974-78 it reached almost 34 percent. Focusing on the period 1974-78, this ratio is the highest for East Germany (40 percent), followed by Czechoslovakia (36 percent), Bulgaria (34 percent), Hungary (32 percent), Poland (31 percent), and Romania (6 percent).

The present value of implicit Soviet trade subsidies to individual CMEA countries in 1980 dollars indicates how much resources in terms of 1980 dollars, inclusive of compound interest (all pre-1980 subsidies are discounted forward), the Soviet Union transferred to individual Eastern European countries. The present value of implicit Soviet trade subsidies to the CMEA Six during 1960-78 is about 57.7 billion dollars, of which 23.7 billion dollars was granted to East Germany, 12.0 billion dollars to Czechoslovakia, 10.1 billion dollars to Poland, 7.8 billion dollars to Hungary, and 4.6 billion dollars to Bulgaria. In the case of Romania, the implicit trade taxes charged by the Soviet Union, amounting close to 1.0 billion dollars during 1960-69, more than offset the implicit subsidies of about 0.5 billion during 1970-78; consequently, over the entire period 1960-78 the Soviet Union imposed net implicit trade taxes on Romania amounting to about 0.5 billion dollars. If we take into account the dramatic growth in Soviet subsidies to Eastern Europe in 1979 and 1980 (see below), the present value of implicit Soviet trade subsidies to the CMEA Six during 1960-80 reaches 88.4 billion dollars.

While our study covered only the period 1960-78, an attempt was also made to estimate roughly the magnitude of Soviet subsidies to Eastern Europe in 1979 and 1980. Predictably, in view of the rapid growth of wmp's of oil and relatively slow growth in the intra-CMEA ftp's for Soviet oil permitted by the 1975 intra-CMEA price-formation formula, these subsidies have dramatically risen. While during 1974-78 they averaged about 5.8 billion dollars annually,

in 1979 they are likely to have reached about 9.5 billion dollars, and in 1980 they are expected to reach a truly staggering magnitude -- almost 20 billion dollars, or as much as 85 percent of total Soviet imports from the Developed West.

Another important finding is that the results of our research indicate that at official exchange rates the ruble (as well as the national devisa currencies of the CMEA Six) is greatly overvalued vis-à-vis the dollar. Whereas during 1960-71 the official exchange rate was \$ 1.1111 = R 1, a "realistic" exchange rate should have been in the range of \$ 0.60 - 0.68 = R 1. During 1972-78 the ruble was overvalued between 56 and 72 percent vis-à-vis the dollar at official exchange rates, the year 1974 being the only exception. A rather encouraging finding is that the dollar/ruble exchange rate selected by us as being the most "realistic," namely the derived Soviet import exchange rate, has moved very closely with the Hungarian commercial dollar/ruble exchange rate, which is supposed to be set at a "realistic" level.

Finally, in a section dealing with CMEA trade reform, we present insight into the set of corrections in the official dollar/ruble exchange rate and in the structure of intra-CMEA ftp's which, *ceteris paribus*, would have produced a realistic ruble/dollar exchange rate and equality between relative intra-CMEA ftp's and relative wmp's during 1960-78. Thus, e.g., in order to equalize the overall average intra-CMEA price level with the average level of wmp's in 1978 the official dollar/ruble exchange rate should have been reduced by about 49 percent (from 1.4634 to about 0.98 dollars per one ruble). Next, in order to eliminate the relative price distortions in intra-CMEA ftp's vis-à-vis the wmp's in 1978, the average intra-CMEA ftp's of machinery and equipment should have been lowered by 46 percent, ftp's of fuels should have been increased by about 59 percent, ftp's of non-food raw materials should have been increased by about 39 percent, ftp's of food and raw materials for food should have been increased by 25 percent, and finally the ftp's of industrial consumer goods should have been lowered by 27 percent.

IMPLICIT SUBSIDIES IN SOVIET TRADE
WITH EASTERN EUROPE*

by

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PERMISSION FROM THE AUTHORS

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I. Introduction

In a recent paper [Marrese and VaXous, 1980a] the authors have presented three stylized observations about the economies of Eastern Europe and the Soviet Union for the period 1960-80:

- (i) within the Council for Mutual Economic Assistance (CMEA), the Soviet Union has been "subsidizing" certain Eastern European countries by exporting "hard goods" (fuels, non-food raw materials, and to a lesser degree also food and raw materials for food) at prices below world market prices (wmp's) in exchange for imports of "soft goods" (machinery, equipment, and industrial consumer goods) at prices above wmp's, especially if account is taken of the relatively lower quality of Eastern European manufactures in comparison with their Western counterparts;¹
- (ii) within CMEA, trade between any two Eastern European countries generally exhibits balanced trade in "hard goods" and a balanced trade in "soft goods";
- (iii) Soviet national security is produced from a combination of Soviet troops and military hardware in the Soviet Union, Soviet troops and military hardware stationed in Eastern Europe, and the allegiance of Eastern European countries.

The first observation indicates that two different sets of terms of trade exist simultaneously for the Soviet Union -- prevailing two-way terms of trade on the world market as well as what appear to be inferior one-way terms of trade with Eastern European countries.² Since the theory of international trade argues that the profit opportunities inherent in arbitrage effectively exclude simultaneous existence of two different terms of trade, the first observation suggests that the assumptions underlying the theory of international trade do not hold completely for the Soviet Union.

The second observation indicates that Soviet trade behavior within CMEA is not typical of other bilateral trade behavior within CMEA. Instead, bilateral barter between Eastern European countries may be expected to produce trade flows which do not show any clear pattern of subsidization. Therefore, some

aspect of the Soviet Union's relationship to Eastern Europe, other than socialist or ethnic solidarity or purely altruistic motives, may hold the key to understanding the presence of the two sets of terms of trade.

The third observation implies that the allegiance of Eastern European countries can serve as a substitute for the use of Soviet labor and capital in providing security services. Because the Soviet Union is the dominant power within CMEA, the authors contend that the Soviet Union utilizes this tradeoff. In other words, the Soviet Union engages in preferential trade treatment of Eastern Europe relative to the rest of the world in order to sustain the allegiance of Eastern European countries.

The term allegiance refers to the aggregate of unconventional gains from trade (non-market benefits of bilateral agreements), which fall into four categories: military, political, ideological, and economic. The most important types of military benefits to the Soviet Union have been: (i) creation and maintenance of the Warsaw Pact military alliance; (ii) existence of a safety corridor ("cordon sanitaire") between the Soviet Union and Western Europe; (iii) availability of military bases in strategic locations;³ (iv) proxy intervention in Third World countries on behalf of the Soviet Union. Political benefits have included voting along alliance lines in international forums, informal Eastern European government and media support, and to some extent also the support and friendship of the population of some Eastern European countries. Ideological benefits have primarily occurred through acceptance of the Soviet brand of communist political ideology and its propagation to other countries. While most economic benefits have been conventional in nature, several may be classified as unconventional: increased economic stability in CMEA, reduced

risk of disrupted flow of strategic commodities (technologically superior machinery from East Germany and Czechoslovakia), and reduced risk of refusal to purchase Soviet exports for reasons other than their price-competitiveness.

The presence of unconventional gains from trade arises because of conflicts among the preferences of different groups in society. This motivates some governments to choose bilateral preferential trade treatment as a hidden way of generating these non-market benefits. This topic is discussed in detail in Marrese and Vaňous [1980a, 1980b].

The aim of this paper is to present empirical evidence on the presence of implicit Soviet trade subsidies granted to Eastern Europe in order to secure unconventional gains from trade. The determinants of these subsidies are in turn discussed in Marrese and Vaňous [1980c].

II. Results of Previous Research⁴

The discussion of the presence of implicit trade subsidies in Soviet trade with Eastern Europe is not entirely new. It began with two articles by Menderhausen [1959, 1960] and grew into the so-called "price discrimination debate". The results of Menderhausen's empirical work indicated the presence of Soviet discrimination against Eastern Europe in favor of Western Europe. Menderhausen found that for each of the years 1955 - 58, Western Europe paid between 7 - 16 percent less for Soviet exports than Eastern Europe paid for the same goods. In the case of Soviet exports, the sample included 47 to 49 commodities, which accounted for 47 - 64 percent of total Soviet exports to Eastern Europe. At the same time, the Soviet Union was found to pay Western Europe about 13 - 22 percent more than it paid Eastern Europe for the same imports. In this case, the sample included 17 to 25 commodities, which accounted for a mere 8 - 12 percent of Soviet imports from Eastern Europe.⁵

On the basis of the above evidence and with a few casual qualifications Menderhausen concluded that "...Soviet foreign trade data showed evidence of price discrimination at the expense of the smaller communist countries in Europe."⁶ Menderhausen suspected that this result was due to the monopolistic-monopsonistic position of the Soviet Union and its consequent ability to reap profits as a dominant buyer and seller.⁷ He did not imply the presence of a conscious effort to discriminate against Eastern Europe on the part of the Soviet decisionmakers, rather he found "... it (is) conceivable that the Soviet government does not even create the observed price differentials and one may even wonder if it is aware of an economic mechanism that tends to produce them."⁸

There are several fundamental flaws in Menderhausen's analysis. To begin

with, higher Soviet export prices to Western Europe do not necessarily indicate the presence of price discrimination. Rather they may reflect the overvaluation of the ruble used in intra-CMEA trade transactions.⁹ In order to prove the presence of Soviet price discrimination against Eastern Europe, one would have had to prove that the Soviet Union's terms of trade with Western Europe were superior to those with Eastern Europe. All that Menderhausen proved was that at the official exchange rate Soviet export prices of primary commodities (fuels, non-food raw materials, and food and raw materials for food) to Eastern Europe exceeded those to Western Europe. His import sample was too small and unrepresentative of the structure of Soviet imports from Eastern Europe. Consequently, no general statement on the relationship between Soviet import prices from Eastern and Western Europe should have been made and any conclusion concerning Soviet terms of trade with Eastern Europe was bound to be extremely unreliable.

What is particularly striking is that Menderhausen missed an obvious clue to the correct conclusion on who discriminates against whom from one of the tables of calculations he presented. He found the degree of price discrimination for two types of machinery (tractors and automobiles) and cotton textiles exported by the Soviet Union to Eastern Europe relative to Western Europe much higher than for most primary commodities.¹⁰ Since the Soviet Union was known to be a large net importer of machinery and industrial consumer goods and since the export sample indicated the greater degree of price discrimination in the case of manufactured commodities, it was likely that the Soviet Union and not Eastern Europe was being discriminated against.

Menderhausen's results were also strongly criticized by Holzman [1962, 1965] for different reasons. Holzman disagreed with Menderhausen's use of East-West

trade prices as proxies for wmp's. He argued that the problem with using East-West trade prices is that, for several reasons, the Soviet Union and Eastern Europe were discriminated against by the rest of the world. If this were the case, then Menderhausen's methodology would make it appear that each member of CMEA was discriminating against the other members even if they all used non-discriminatory wmp's to trade among themselves.¹¹

We do not believe that Holzman's discrimination argument is a matter of substantial importance for the period 1960-80. In our opinion, CMEA imports from the West were generally purchased at wmp's during 1960-80, except for covert importation of embargoed strategic commodities (including some high-technology items) and some proportion of purchasing mistakes (which may perhaps plague CMEA countries more than others). As far as the prices of CMEA exports to the West are concerned, we would concede that Holzman's point may have some validity during the 1950's and early 1960's, but very little relevance during the latter half of the 1960's and in the 1970's.¹²

The second of Holzman's objections to Menderhausen's results centered around the proper criterion to use in the analysis of discrimination. Holzman objected to the use of wmp's as the proper norm. He hypothesized that CMEA is a particular type of customs union, within which prices are set half-way between the production cost of the (low-cost) exporter and the (high-cost) importer. Thus intra-CMEA ftp's above or below wmp's for the same goods have nothing to do with discrimination, but rather they indicate what goods CMEA has a comparative advantage or disadvantage in producing. Hence, according to Holzman, Menderhausen-type calculations actually measure the "custom-union" effect of CMEA's decision to be a relatively closed trading area.¹³

The problem with this explanation is two-fold. First, we have been unable to find any evidence in the literature on CMEA price formation to the effect that a price-formation rule of the kind suggested by Holzman was ever implemented by CMEA. In addition, as Hewett points out, the voluminous literature which appeared in the 1960's on price reform in CMEA makes it quite clear that CMEA price setters do not, as yet, systematically use information on real costs of production in the process of determining intra-CMEA ftp's.¹⁴

In a subsequent study, Marer [1968] tried to estimate the opportunity cost to Hungary of trading at CMEA ftp's rather than at the wmp's Hungary might have received if she were not a CMEA member. As a proxy for wmp's Hungary might have received, Marer chose Austrian exports and import unit values on the world market. His results were rather puzzling. He found that during 1955-57 Hungary did very well in her trade with the Soviet Union, obtaining 20 percent better terms of trade than she might have obtained on the world market. However, the situation reversed itself during the 1958-64 period when Hungary obtained on the average 11 percent poorer terms of trade than she might have obtained on the world market.¹⁵ Marer had difficulty in explaining the switch in the pattern of discrimination in 1958. He suggested that the data for the period 1955-57 were at least partially affected by the post-revolution economic aid to Hungary and that the post-1957 situation was probably more representative of the real situation. Hewett suggested an alternative explanation, namely that the period 1957-58 was a period of intra-CMEA price reform and it could be that the pattern of discrimination observed by Marer in the case of Hungary dramatically switched because CMEA prices responded to wmp's on the main export markets, not to Austrian export and import prices.¹⁶

The authors have serious doubts about the wisdom of using Austrian unit values as proxies for what Hungary might have obtained for her exports on the world market or might have paid for her imports from the world market if she were not a CMEA member. The correct way of measuring the opportunity cost of CMEA membership would require a calculation based on actual prices Hungary obtained for exports and paid for imports to and from the Soviet Union compared to the Developed West.¹⁷ In view of the relatively low quality of Hungarian manufactured commodities, it is unlikely that Hungary could have earned Austrian unit values for her exports of manufactures on the world market. Consequently, the ratio of the actual Hungarian export prices to the Soviet Union relative to her hypothetical export prices to the West (based on Austrian export unit values) would have been considerably higher than the reported ratio of 1.08 for 1955-57 and 0.9 for 1958-64 if Marer had made the proper downward adjustment.

A similar adjustment would have been appropriate for imports, since Hungary would not have paid Austrian import unit values from the world market for qualitatively-inferior Soviet manufactures if these had been purchased on the world market. Since Hungary has been a significant net exporter of manufactures to and net importer of primary commodities from the Soviet Union, the adjustment on the export side would be considerably greater than on the import side (since trade flows involving primary commodities did not require any adjustment). As a result of these two adjustments, the Hungarian relative terms of trade (the weighted average CMEA ftp/wmp ratio for exports over the weighted average CMEA ftp/wmp ratio for imports) would have indicated that Hungary discriminated against the Soviet Union during 1958-64 -- contrary to the conclusion reached by Marer. However, the extent of Hungarian price discrimination against the Soviet

Union probably declined during 1958-64 relative to 1955-57 as a result of the 1957-58 intra-CMEA price reform. It also may be the case that the large decline in the extent of Hungarian price discrimination between 1957 and 1958 reported by Marer has more to do with the use of Austrian unit values instead of actual Hungarian prices achieved in the Developed West.

There are two essential weaknesses in most of the research on the subject of discrimination that appeared in the late 1950's and in the 1960's. The first weakness is the failure to define the concept of discrimination. The second weakness is the failure to understand the concept of the opportunity cost of CMEA membership.

As far as the concept of discrimination is concerned, Wiles [1969] and Marer [1972b] helped most to clarify it. Wiles observed that, in addition to the relative terms of trade as a discrimination criterion, the quantities traded are just as important. He pointed out that even if all CMEA ftp's were identical to wmp's, there would be discrimination if one country is forced to supply the others with more of some commodity than she would under conditions of completely free choice.¹⁸ Subsequently, Marer noted that "... if one recalculated the balance of trade within CMEA for various pairs of countries at wmp's (i.e., from trade flows valued at adjusted dollar prices, by proportionately deflating or inflating official trade statistics according to whether actual price levels were above or below wmp levels), in many cases one would find that trade would no longer be bilaterally balanced. Since prices of manufactures are considerably higher relative to world prices than those of raw materials, such a revaluation would mainly benefit the USSR and would be disadvantageous to East Germany, Czechoslovakia, and Hungary."¹⁹ Without

explicitly stating so, Marer arrived closer than anybody else to the best measure of the opportunity cost of CMEA membership that takes into account both the relative terms of trade and the physical quantities of goods traded.

The standard measure of discrimination used in most studies of CMEA trade are the so-called relative terms of trade. The relative terms of trade are calculated according to the following formula:

$$\frac{\frac{\text{actual price of country's exports}}{\text{opportunity cost of country's exports}}}{\frac{\text{actual price of country's imports}}{\text{opportunity cost of country's imports}}}$$

where the opportunity cost of country's exports and imports are approximated by East-West trade prices, wmp's, or trade prices of a "similar" Western economy. The problem with this measure of discrimination is that it completely ignores the physical quantities of commodities traded. It is not particularly interesting to discover that one country greatly discriminates against another if the total volume of trade between the two countries is very small (which may well be caused by the presence of price discrimination). On the other hand, a small degree of price discrimination involving a large volume of trade may well result in a large implicit transfer of resources from one country to another in absolute terms.

Marer's measure of the opportunity cost of CMEA membership based on the recalculation of balances of trade at wmp's does not suffer from the above problem because it takes into account the physical quantities of commodities traded. However, this measure is not a completely correct approximation of the opportunity cost of CMEA membership if trade balances valued at intra-CMEA ftp's and measured in rubles or national devisa currencies deviate from

zero. With non-zero ruble trade balance, the correct measure of the opportunity cost of CMEA membership (the transfer of resources from one country to another through implicit trade subsidies) is the difference between the recalculated overall balance of trade at wmp's measured in dollars and the original overall balance of trade at intra-CMEA ftp's measured in rubles, which is converted into dollars using a realistic dollar/ruble settlement exchange rate.²⁰ This, in fact, is the measure of the economic opportunity cost of CMEA membership to the Soviet Union employed by the authors in this study.²¹

The misunderstanding surrounding the opportunity cost of CMEA membership centers around the measure of the opportunity cost for a country's exports and imports. Three basic measures of the opportunity cost have been used by different researchers: East-West trade prices, world market prices, and trade prices of a "similar" Western economy. If one is interested in the opportunity cost of CMEA membership, the relevant prices are East-West trade prices or prices derived from these that take into account the price elasticities of Western demand and supply of particular commodities. Whether these prices are "unfair", embody elements of Western discrimination against the East, or deviate from true wmp's is not relevant here because we are interested in the measurement of the actual opportunity cost of CMEA membership. Wmp's are not relevant for this purpose because they do not reflect the true opportunity cost; on the other hand, the use of wmp's is certainly appropriate if we are interested in a study of the price-determination process in CMEA. Trade prices of a "similar" Western economy are not particularly useful either for the study of the opportunity cost of CMEA membership or the study of the price-determination process in CMEA because they neither reflect the true opportunity cost of CMEA country's exports and imports, nor are these prices used by CMEA price setters as a base for the formation of intra-CMEA ftp's.

III. Calculation of Implicit Trade Subsidies

Consider the following notation:

$B_t^R = VX_t^R - VM_t^R$ = overall Soviet trade balance with a particular CMEA partner country in year t, measured in rubles;

$B_t^{\$} = VX_t^{\$} - VM_t^{\$}$ = overall Soviet trade balance with a particular CMEA country in year t, measured in dollars;

$B_{jt}^{\$} = VX_{jt}^{\$} - VM_{jt}^{\$}$ = Soviet trade balance in commodity category j in year t with a particular CMEA country, measured in dollars;

EM_{jt}, EX_{jt} = derived dollar/ruble exchange rate (dollars per one ruble) for Soviet imports and exports of goods in commodity category j in year t with a particular CMEA country;

F_t = settlement dollar/ruble exchange rate (dollars per one ruble), i.e., the rate at which trade surpluses or deficits denominated in rubles can be eliminated by dollar payments to or from the USSR;

PM_{ijt}^R, PX_{ijt}^R = unit f.o.b. price of Soviet imports and exports of commodity i in commodity category j in year t with a particular CMEA country, denominated in rubles;

$PM_{ijt}^{\$}, PX_{ijt}^{\$}$ = unit f.o.b. world market price of Soviet imports and exports (Soviet import price from and export price to the Developed West) of commodity i in commodity category j in year t, denominated in dollars;

$PM_{jt}^{\$}$ = average unit world market price of goods in commodity category j in year t;

QM_{ijt}, QX_{ijt} = quantity of Soviet imports and exports of commodity i in commodity category j in year t from and to a particular CMEA country.

measured in metric tons or other physical units;

$S_t^{\$}$ = implicit Soviet trade subsidies to a particular CMEA country in year t, measured in dollars;

VM_{ijt}^R, VX_{ijt}^R = value of Soviet imports and exports of goods in commodity category j in year t from and to a particular CMEA country, measured in rubles;

VM_{ijt}^R = $QM_{ijt} \cdot PM_{ijt}^R$ = value of Soviet imports of commodity i in commodity category j in year t from a particular CMEA country, measured in rubles;

VX_{ijt}^R = $QX_{ijt} \cdot PX_{ijt}^R$ = value of Soviet exports of commodity i in commodity category j in year t to a particular CMEA country, measured in rubles;

$VM_{ijt}^{\$}, VX_{ijt}^{\$}$ = value of Soviet imports and exports of goods in commodity category j in year t from and to a particular CMEA country, measured in dollars;

$VM_{ijt}^{\$}$ = $QM_{ijt} \cdot PM_{ijt}^{\$}$ = value of Soviet imports of commodity i in commodity category j in year t from a particular CMEA country, measured in dollars;

$VX_{ijt}^{\$}$ = $QX_{ijt} \cdot PX_{ijt}^{\$}$ = value of Soviet exports of commodity i in commodity category j in year t to a particular CMEA country, measured in dollars.

If we had information on all physical quantities of commodities traded by the USSR with each CMEA country, i.e., 100 percent coverage of the sample of QM_{ijt} 's and QX_{ijt} 's, and if the USSR always maintained a zero overall ruble trade balance with each partner country, then the calculation of the implicit

Soviet trade subsidies would be very simple. In particular, the implicit Soviet trade subsidies transferred to a specific CMEA country in year t would equal the overall bilateral trade balance measured in dollars:

$$\begin{aligned}
 S_t^{\$} &= \sum_j \sum_i (QX_{ij t} \cdot PX_{ij t}^{\$}) - \sum_j \sum_i (QM_{ij t} \cdot PM_{ij t}^{\$}) = \sum_j VX_{j t}^{\$} - \sum_j VM_{j t}^{\$} = \\
 &= VX_t^{\$} - VM_t^{\$} = \sum_j B_{j t}^{\$} = B_t^{\$}, \quad \dots(1) \\
 i &= 1, \dots, n_j \\
 j &= 1, \dots, 5.
 \end{aligned}$$

However, equation (1) cannot be used for the calculation of the implicit Soviet trade subsidies because the above two conditions are typically not satisfied. In actual empirical work the sample of physical quantities of commodities typically has less than 100 percent coverage. In addition, the overall Soviet ruble trade balance is never exactly equal to zero, even though the presence of bilateralism in Soviet trade relations with Eastern Europe tends to reduce large potential imbalances between overall exports and imports.

In the presence of an incomplete sample coverage and unbalanced overall trade, the calculation of the implicit Soviet trade subsidies has to be done in the following three steps. First, for each CMEA partner country, conversion rates have to be derived to translate ruble trade flows calculated at intra-CMEA ftp's into dollar trade flows calculated at wmp's on the basis of a sample of commodities with less than 100 percent coverage. This calculation has to be made separately for exports and imports in each commodity category. The derived conversion rate (in dollars per one ruble) for exports of commodity j to a particular CMEA country is:

$$EX_{jt} = \sum_{i=1}^{m_j} (QX_{ijt} \cdot PX_{ijt}^S) / \sum_{i=1}^{m_j} (QX_{ijt} \cdot PX_{ijt}^R) \quad \dots(2)$$

$$i = 1, \dots, m_j < n_j$$

$$j = 1, \dots, 5$$

and for imports of commodity j the derived conversion rate is:

$$EM_{jt} = \sum_{i=1}^{m_j} (QM_{ijt} \cdot PM_{ijt}^S) / \sum_{i=1}^{m_j} (QM_{ijt} \cdot PM_{ijt}^R) \quad \dots(3)$$

$$i = 1, \dots, m_j < n_j$$

$$j = 1, \dots, 5.$$

Second, using the above conversion rates, Soviet ruble trade flows with each CMEA country are converted into dollars. We assume that the exchange rate calculated on the basis of the available sample of commodities is valid for the entire trade in a given commodity category. Thus the value of exports of commodity j measured at wmp's and in dollars equals

$$VX_{jt}^S = VX_{jt}^R \cdot EX_{jt}, \quad \dots(4)$$

and the value of imports of commodity j equals

$$VM_{jt}^S = VM_{jt}^R \cdot EM_{jt}. \quad \dots(5)$$

Finally, the implicit trade subsidies corrected for non-zero overall Soviet ruble trade balance equal

$$S_t^S = \sum_j (VX_{jt}^S - VM_{jt}^S) - [\sum_j (VX_{jt}^R - VM_{jt}^R) \cdot F_t] = (VX_t^S - VM_t^S) - [(VX_t^R - VM_t^R) \cdot F_t] = B_t^S - (B_t^R \cdot F_t). \quad \dots(6)$$

Equation (6) has been utilized in our calculation of implicit Soviet trade subsidies.

In the course of the collection of data necessary for the calculation of the subsidies as well as during the calculation itself, numerous problems had to be resolved in the following areas:

- (i) choice of the correct opportunity cost measure for Soviet exports to and imports from Eastern Europe;
- (ii) selection of commodity categories which were sufficiently homogeneous;
- (iii) cases of zero sample commodity coverage;
- (iv) cases of poor sample commodity coverage;
- (v) taking account of the presence of trade in dollars and at wmp's between the USSR and individual Eastern European countries;
- (vi) choice of the dollar/ruble settlement exchange rate F_t .

As far as the correct measure of the opportunity cost for Soviet exports to and imports from Eastern Europe is concerned, we have argued that only actual East-West trade prices are appropriate. By East-West trade prices we mean Soviet export prices to and import prices from the Developed West (Western Europe, North America, Japan, Australia, and New Zealand). Prices in Soviet trade with the Less Developed Countries were intentionally ignored because at least some of them are influenced by political and other considerations of the type that influence intra-CMEA ftp's. Two problems arose with respect to the choice of East-West trade prices. First, some of the commodities that the Soviet Union exports to Eastern Europe are not exported to the Developed West and some commodities are imported only from Eastern Europe. In those cases, missing observations on prices in East-West trade had to be filled using the data on prices in Hungarian trade with the West, or wmp quotations available from IMF and World Bank publications.²²

Second, in many cases the observed quantity of Soviet exports to and imports from the West was very small and thus one had to ask whether the observed average price for exports and imports would also prevail if trade increased by more than marginal amounts. As far as the Soviet imports from the West are concerned, in those primary commodity categories in which a large increase in the quantity of imports would have taken place had the Soviet Union redirected all its imports from Eastern Europe to the West, the Soviet Union's position on the world market would still have been that of a relatively small country. Hence it is unlikely that the average Soviet import prices of primary commodities from the West would have risen substantially above the actually observed average import prices. Consequently, the authors decided to assume perfectly elastic Western supply of primary commodities to the Soviet Union.

In the case of Soviet exports of primary commodities to the West, such an assumption is more problematic. The Soviet Union is a fairly important supplier of oil and certain non-food raw materials on the world market and thus may not face perfectly elastic Western demand for its exports of these commodities. However, in the absence of detailed information on price elasticities of Western demand for particular primary commodities, a downward adjustment of observed average Western import prices (Soviet export prices) would have amounted to unsubstantiated guesswork. Since, in our opinion, the appropriate downward price adjustment would be a small one, we decided to use the actually observed average Soviet export prices to the West in our calculations.

In the case of Soviet imports of machinery and equipment and industrial consumer goods, and Soviet exports of machinery and equipment, the assumption of perfectly elastic Western supply seemed less reasonable and the assumption

of perfectly elastic Western demand was out of question. Because Eastern Europe and the Soviet Union export a relatively small amount of manufactures to the West and because these goods are typically of low quality when compared to Western manufactures, it can be expected that a sharp increase in their exports to the West would require substantial price reductions. This view is based on the notion that the Soviet Union and Eastern Europe have something of a "monopolistic position" in the supply of low-quality manufactures on the world market, and therefore are more likely to face fairly inelastic Western demand for their exports.²³ An additional problem is that only the best Eastern manufactures are exported to the West and thus the observed average export prices need not even be relevant for most categories of manufactured goods. Simply stated, if manufactures traded between the Soviet Union and Eastern Europe were placed on the world market, in order to make them salable they would have to be substantially discounted.

In view of the fact that we did not have any data on prices of specific manufactured commodities either in intra-CMEA trade or in East-West trade, we had no choice but to make educated guesses as to the magnitude of these discounts from prevailing wmp levels. When estimating the discounts, we kept in our mind the fact that Western demand for Soviet and Eastern European manufactures is probably quite price-inelastic especially for large increases in the quantity of exports, and that Western supply of manufactures to CMEA may not be perfectly price elastic because the Soviet Union is a fairly large importer of manufactured goods relative to the size of the world market.²⁴

One of the most important tasks in our research was the selection of the sample of commodities for which intra-CMEA and East-West trade prices were to be compared. The data available to us from official Soviet foreign trade

statistics were unit values and in order to be able to argue that the comparison of prices and unit values amounts to the same thing, commodity categories had to be carefully defined so that they were as homogeneous as possible.²⁵ As can be expected, the degree of homogeneity of commodities generally declines with the degree of processing and/or manufacturing; hence the comparison of unit values instead of actual prices is more valid for primary commodities rather than for manufactured commodities.

In the course of the selection of our sample it became quickly apparent that no commodity was sufficiently homogeneous in the case of Soviet exports of machinery and equipment, imports of machinery and equipment, and imports of industrial consumer goods. Thus in these three cases we ended up with no sample. In addition, quite a few primary commodities had to be excluded from our sample as well either because a particular commodity category was too heterogeneous or because of misleading units of measurement.²⁶ A complete list of commodities covered by our sample, which were judged by us to be sufficiently homogeneous, is presented in Table A-1 in Appendix I. Information on the quality of our sample in terms of the percentage of an aggregate trade flow in a particular commodity group covered by our sample is presented in Tables A-2 through A-5 in Appendix I.

Probably the most difficult problem encountered in our research was the problem of handling the above three cases of aggregate commodity trade flows for which no sample was available. In order to construct the time series of derived dollar/ruble exchange rates for these three commodity trade flows, i.e., time series of EM_{jt} 's and EX_{jt} 's, an alternative three-stage procedure was devised.

In the first stage, three dollar/ruble exchange rates had to be estimated

for each CMEA country for year 1960, namely $EX_{1,1960}$ for Soviet exports of machinery and equipment, $EM_{1,1960}$ for Soviet imports of machinery and equipment, and $EM_{5,1960}$ for Soviet imports of industrial consumer goods. In the second stage, estimates of intra-CMEA ruble ftp indices and East-West trade dollar price indices for the period 1960-78 were constructed from various sources. In the third stage, the estimates of dollar/ruble exchange rates were extended for the period 1961-78 using the benchmark estimates for 1960 and the information on the rate of growth in the dollar and the ruble price indices constructed during the second stage. A detailed description of this procedure and the sources of data used appears in Appendix II of the paper.

Still another problem that had to be resolved involved the question what to do in cases in which the estimates of derived dollar/ruble exchange rates EM_{jt} or EX_{jt} were based on poor samples, i.e., only a small percentage of the aggregate trade flow in a particular commodity category was covered by our sample. Three options were available to us. First, we could accept the initial estimate of the dollar/ruble exchange rate and ignore the fact that it was based on a poor sample and hence it may not be particularly representative. Second, we could replace the initial estimate of the dollar/ruble exchange rate by a weighted average based on the initial country estimate and an average estimate for all of Eastern Europe. It seemed sensible that the percentage of the total aggregate trade flow covered by the sample should serve as a weight for the initial country estimate and the percentage of the aggregate trade flow not covered by the sample should serve as a weight for the estimate of the derived dollar/ruble exchange rate for the CMEA Six taken together.²⁷ Third, we could replace the initial estimate of the dollar/

ruble exchange rate by a weighted average based on the initial country estimate and another estimate of the dollar/ruble exchange rate believed to be representative for the portion of the aggregate trade flow not covered by our sample.

In all cases, we rejected the first option as being too simplistic. The second option was chosen whenever the sample for all of Eastern Europe provided good commodity coverage, which proved to be the majority of cases. All estimates of country dollar/ruble exchange rates for particular commodity trade flows that were adjusted in this fashion are marked * in Tables A-13 through A-18 presented in Appendix IV.

Finally, in the case of the Soviet imports of non-food raw materials from Eastern Europe, the third option was chosen. As revealed by Table A-3 in Appendix I, the commodity coverage of the sample of Soviet imports of non-food raw materials from Czechoslovakia, East Germany, and Hungary was very poor. The commodities covered by our sample were mostly semi-fabricates and manufactured raw materials; most commodities missing from the sample were either known or believed to be ores (uranium) and concentrates and other primary raw materials of strategic nature.²⁸ Since no information was available to us on Soviet import prices of uranium ores and other "unspecified" non-food raw materials, we had two choices: either to assume that these two commodities were priced relative to wmp's the same way as Soviet imports of semifabricates and manufactured raw materials from Eastern Europe, or they were priced relative to wmp's as Soviet exports of non-food raw materials to Eastern Europe, which tend to be less processed and more primary in nature. The latter choice seemed more sensible to us and we adjusted the country estimates of the derived dollar/ruble exchange rates for Soviet imports of non-food raw materials from

Eastern Europe by assuming that for the portion of each trade flow not covered by our sample the appropriate dollar/ruble exchange rate was the average Soviet dollar/ruble exchange rate for exports of non-food raw materials to all of Eastern Europe. All estimates of country dollar/ruble exchange rates for Soviet imports of non-food raw materials were adjusted in this fashion and are marked + in Tables A-13 through A-18 presented in Appendix IV.

One problem that could not be resolved satisfactorily was the consideration of the presence of trade in dollars and at wmp's between the Soviet Union and individual Eastern European countries. No direct information on the proportion of Soviet exports to and imports from Eastern Europe which are sold or bought for dollars at wmp's is available and hence it was not possible to adjust our calculations for the bias due to this omission.²⁹ However, we are able to show that the resultant bias in our calculation of implicit Soviet trade subsidies is not that large so as to affect our findings to a significant degree.

For the sake of simplicity, assume that we have only one aggregate commodity that is exported and one aggregate commodity that is imported. Further assume that α is the share of the physical quantity of exports sold for rubles and β is the share of the physical quantity of imports bought for rubles. Consequently, $(1 - \alpha)$ and $(1 - \beta)$ are the respective shares of exports sold for dollars and imports purchased for dollars at wmp's. Then the correctly calculated value of Soviet exports measured in dollars and at wmp's is:

$$VX_{\$}^{*} = (PX_R \cdot \alpha \cdot QX \cdot EX_{\$/R}) + [(PX_{\$} \cdot (1 - \alpha) \cdot QX \cdot E_{R/\$})/E_{R/\$}] \dots (7)$$

where $EX_{\$/R}$ = derived dollar/ruble exchange rate (dollars per one ruble)
for Soviet exports;

$E_{R/\$}$ = official ruble/dollar exchange rate (rubles per one dollar),
which is identical for exports and imports;

PX_R = unit intra-CMEA price of exports, denominated in rubles;

$PX_{\$}$ = unit wmp of exports, denominated in dollars;

QX = quantity of exports.

The value of Soviet exports measured in dollars and at wmp's that we are actually able to calculate is:

$$VX_{\$} = [(PX_R \cdot \alpha \cdot QX) + (PX_{\$} \cdot (1 - \alpha) \cdot QX \cdot E_{R/\$})] \cdot EX_{\$/R} \quad \dots(8)$$

Thus the error in our calculation of Soviet exports measured in dollars and at wmp's equals:

$$VX_{\$}^* - VX_{\$} = PX_{\$} \cdot (1 - \alpha) \cdot QX \cdot [1 - (E_{R/\$} \cdot EX_{\$/R})] \quad \dots(9)$$

Similarly, for Soviet imports measured in dollars and at wmp's the difference between the correct calculation and the calculation we are able to make is:

$$VM_{\$}^* - VM_{\$} = PM_{\$} \cdot (1 - \beta) \cdot QM \cdot [1 - (E_{R/\$} \cdot EM_{\$/R})] \quad \dots(10)$$

Consequently, the error we make in the calculation of the Soviet trade balance measured in dollars and at wmp's (hence also in the calculation of the implicit trade subsidies provided both the ruble and the dollar trade balances equal zero) is:

$$\begin{aligned} B_{\$}^* - B_{\$} &= (VX_{\$}^* - VM_{\$}^*) - (VX_{\$} - VM_{\$}) = \\ &= \{PX_{\$} \cdot (1 - \alpha) \cdot QX \cdot [1 - (E_{R/\$} \cdot EX_{\$/R})]\} \\ &\quad \{PM_{\$} \cdot (1 - \beta) \cdot QM \cdot [1 - (E_{R/\$} \cdot EM_{\$/R})]\} \quad \dots(11) \end{aligned}$$

Therefore, the bias in the calculation of the trade balance depends on the magnitudes of α and β , and the degree to which the products of exchange rates, $(E_{R/\$} \cdot EX_{\$/R})$ and $(E_{R/\$} \cdot EM_{\$/R})$, deviate from unity.

For the sake of argument, let us assume that $\alpha = \beta = 0.90$ and $PX_{\$} \cdot QX = PM_{\$} \cdot QM$, i.e., the values of Soviet exports to and imports from Eastern Europe transacted in dollars and at wmp's are equal (hence the actual Soviet dollar trade balance is zero). In this case, equation (11) reduces to

$$B_{\$}^* - B_{\$} = 0.10 \cdot PX_{\$} \cdot QX \cdot E_{R/\$} \cdot (EM_{\$/R} - EX_{\$/R}). \quad \dots(12)$$

Actual calculations presented in Table 1 below (see Section V) indicate that during the 1970's the difference between the dollar/ruble exchange rate for Soviet imports from Eastern Europe and that for Soviet exports to Eastern Europe, $(EM_{\$/R} - EX_{\$/R})$, ranged between -0.10 (1972) and -0.72 (1974) dollars. The official exchange rate of the ruble vis-à-vis the dollar, $E_{R/\$}$, ranged between 0.68 and 0.90.³⁰ Thus the upward bias in the calculation of the hypothetical dollar trade balance under the assumption of zero Soviet trade balance in actual dollar trade with Eastern Europe and 10 percent share of dollar trade in total real trade would be between 0.8 and 5.5 percent.³¹ As a result of our failure to incorporate the effect of intra-CMEA dollar trade into our calculations, any overestimate of the implicit Soviet trade subsidies to Eastern Europe would be of corresponding magnitude.

The last important problem to be resolved was the choice of the dollar/ruble settlement exchange rate F_t , i.e., the rate at which trade surpluses or deficits denominated in rubles can be eliminated by dollar payments to or from the USSR. This settlement exchange rate is needed for the calculation of implicit trade subsidies whenever the overall Soviet ruble trade balance with a particular country is different from zero (see equation (6) above). We had several exchange rates available to us, namely the official dollar/ruble exchange rate, derived dollar/ruble exchange rates for Soviet imports from and exports to Eastern Europe, and some information on the Czechoslovak

and Hungarian commercial exchange rates set at "realistic" levels.³²

We selected the derived Soviet dollar/ruble exchange rate for imports from Eastern Europe, which is different for each partner country, as the most appropriate. This rate turned out to be very close to the Czechoslovak and the Hungarian commercial rates, which in our judgement are the best "scarcity" exchange rates available from Eastern European sources. Our choice was also justified by the following reasoning. If the Soviet Union has a ruble trade surplus with a particular CMEA country, this surplus is a claim on future deliveries of imported commodities. If we assume that the surplus will be liquidated by future deliveries of the typical average import bundle of commodities, then the chosen settlement exchange rate should make both parties just indifferent between liquidating the surplus by dollar payments or by physical delivery of the typical Soviet import bundle. One could possibly even take the view that the deficit country will try to offset her deficit (Soviet surplus) by future delivery of the relatively most overpriced commodities, i.e., machinery and equipment, and industrial consumer goods. In this case, the exchange rate F_t should be calculated as a weighted average of the derived dollar/ruble exchange rates for the commodities which will be used in the future to offset the current Soviet trade surplus. We felt that the first assumption was more reasonable; should the latter assumption be more appropriate, then our estimates of the implicit Soviet trade subsidies are slightly biased downward. What happens if the Soviet Union incurs a trade deficit with a particular Eastern European country? The exchange rate F_t is still appropriate because the Eastern European country in the surplus position had an option of diverting her exports to the West and earning exactly the dollar amount the Soviet Union is willing to pay to liquidate the deficit.

Hence, the Eastern European country should be indifferent between the two options and the Soviet Union should prefer this option to liquidating the deficit by future deliveries of relatively underpriced hard goods.

IV. The Data

The calculation of implicit subsidies in Soviet trade with Eastern Europe required the following data for the period 1960-78:

- (i) value of Soviet exports to and imports from each Eastern European country by main commodity categories as originally recorded in rubles;
- (ii) value of Soviet exports and imports of individual commodities (disaggregated by two to seven CTN digits) by country recorded in rubles;³³
- (iii) physical quantities of Soviet exports and imports of individual commodities (disaggregated by two to seven CTN digits) by country recorded in metric tons, square or cubic meters, hectoliters, or other units;
- (iv) unit values (prices per metric ton, etc.) of Soviet exports to and imports from the Developed West of individual commodities (disaggregated by two to seven CTN digits), measured in U.S. dollars.

The data on Soviet exports to and imports from each Eastern European country by five main commodity categories (Machinery and Equipment, Fuels, Non-Food Raw Materials, Food and Raw Materials for Food, and Industrial Consumer Goods) for 1960-77 were taken from Vaňous [1980a], Tables 62 through 68. The data for 1978 were obtained by aggregation of disaggregated data published in the 1978 USSR Foreign Trade Yearbook. In addition, we also used mirror trade data of Eastern European countries in order to distribute the large unspecified trade residuals found in official Soviet foreign trade statistics. The aggregate Soviet bilateral trade data measured in rubles are

presented in Appendix III in Tables A-6 through A-12.

The choice of aggregation of trade flows into five main commodity categories was based on the following considerations. During the period under study three different aggregate classifications were used by CMEA: four-commodity classification (until 1970), five-commodity classification (since 1971), and nine-commodity classification (ten-commodity classification since 1971).³⁴ The nine-commodity classification was rejected because the availability of disaggregate value and quantity data for some commodity categories was extremely limited, hence leading to unreliable estimates of ruble/dollar conversion rates. The four- and five-commodity CMEA classifications were viewed unsatisfactory in view of the fact that Fuels were not treated as a separate commodity category, a major flaw in the aggregate CMEA trade statistics. Another five-commodity classification, employed by Various [1980a], was chosen on the grounds that it was sufficiently aggregative to avoid a problem of poor disaggregate samples (to the degree that it could be avoided) and it had the advantage of treating Fuels as a separate commodity category.

The information on the value and physical quantities of Soviet exports and imports of individual commodities (disaggregated by two to seven CTN digits) to and from Eastern Europe was obtained from three sources. For the period 1960-70 we utilized OER microfilms on USSR Foreign Trade 1960-1970. For years 1971-78 we relied mostly on the official Soviet Foreign Trade Yearbooks. However, since 1976 the quality of official Soviet foreign trade statistics dramatically deteriorated in several respects and whenever possible we attempted to fill the missing observations by utilizing information obtained from mirror Eastern European trade statistics, published in Foreign Trade Yearbooks and national Statistical Yearbooks.

In particular, the deterioration in the quality of the official Soviet foreign trade statistics took the following forms: (i) increased aggregation of commodity trade flows (a process that began as early as 1968), (ii) reporting the value of trade only (omitting physical quantities), and (iii) increasing the proportion of commodity trade flows for which neither the value nor the quantity of trade is reported (rising "unspecified overall trade residuals"). An example of the first kind is the aggregation of Soviet exports of black coal (CTN 200) and coke (CTN 201) into hard fuels (CTN 20) since 1977. An example of the second kind is the absence of physical quantities of exported oil and oil products in Soviet Foreign Trade Yearbooks since 1977. The purpose of this action may have been to make it difficult for researchers to calculate Soviet export unit values to different countries and compare them with each other. This information is suppressed because it reveals which countries are obtaining preferential trade treatment and superior terms of trade, and hence also implicit trade subsidies. An example of the third kind is the complete exclusion of fuel imports from the Soviet foreign trade statistics since 1977. Again, the most likely purpose of this action is to make it difficult for researchers to calculate the net Soviet fuel trade balance; in the case of other commodities, the absence of reporting is probably due to strategic considerations.

However, we were not forced by the above Soviet practices to exclude years 1976-78 from our study. In order to avoid a substantial deterioration in the quality of the sample of commodities studied, missing information on the physical quantities of goods traded, and in some cases both on the value and the physical quantities exchanged, was obtained from mirror trade statistics (mostly for Czechoslovakia, Hungary, and Poland). In particular, in

many cases when only the physical quantity of goods traded was not recorded, it was calculated by first estimating the unit value of a particular commodity trade flow and then dividing the known value of trade by the estimate of the unit value. The key source for estimates of unit values were the Hungarian ruble trade unit-value indices published in KAA [1978] and in the official Hungarian Foreign Trade Yearbook for 1978 - KSE [1979]. In other cases, an educated guess about the physical quantity of goods traded was made and the value of trade was then calculated as a product of the physical quantity of trade and the unit value estimated from the Hungarian foreign trade price statistics.³⁵

The complete list of sample commodities for which we had specific prices, 68 commodities for exports and 47 commodities for imports, is presented in Table A-1 in Appendix I. In addition, in Tables A-2 through A-5 we present information on the quality of our sample in terms of the percentage of an aggregate trade flow in a particular commodity category covered by our sample. This information is provided for trade in fuels, non-food raw materials, food and raw materials for food, and for exports of industrial consumer goods. No sample was available for trade in machinery and equipment, and imports of industrial consumer goods.

The desired measure of the opportunity cost of Soviet exports to and imports from Eastern Europe was the average unit value of Soviet exports to and imports from the Developed West. Whenever possible, this information was obtained by dividing the value of Soviet trade with the Developed West by the quantity of goods traded. The information on the value of trade and the physical quantities of goods traded was obtained from OER microfilms

on USSR Foreign Trade 1960 - 1970 and official Soviet Foreign Trade Yearbooks.

In those cases in which the required data was not available from the above two sources or was not viewed as sufficiently reliable, estimates of Hungarian ftp's in East-West trade or wmp's were substituted for the unit value in Soviet trade with the West. Hungarian ftp's in East-West trade were obtained from KAA [1978] and KSE [1979].³⁷ Estimates of wmp's were obtained from CTPT [1978] and IFS [monthly].³⁸

V. Results of the Estimation of Derived Dollar/Ruble Exchange Rates

The results of the estimation of derived dollar/ruble exchange rates for Soviet exports to and imports from the CMEA Six are presented in Table 1 below. The derived exchange rates for individual Eastern European countries are presented in Tables A-13 through A-18 in Appendix IV. The time series of derived exchange rates are presented separately for five major commodity categories: (i) Machinery and Equipment, (ii) Fuels, (iii) Non-Food Raw Materials, (iv) Food and Raw Materials for Food, and (v) Industrial Consumer Goods. In addition, the derived dollar/ruble exchange rates for all exported and all imported goods taken together are also presented.

As expected, the estimates of derived dollar/ruble exchange rates differ for individual commodities and from year to year. Export exchange rates lie between 0.39 (for machinery and equipment in 1960) and 3.64 (for fuels in 1974) dollars per one ruble; import exchange rates lie in the range between 0.43 (for machinery and equipment in the early 1960's) and 2.02 (for non-food raw materials in 1974). The pattern of differences in derived dollar/ruble exchange rates across commodities conforms to the pattern expected on the basis of our knowledge of the pattern of biases in intra-CMEA relative ftp structure compared to the structure of wmp's. In the 1970's, the highest derived dollar/ruble exchange rates were obtained for Soviet exports of fuels (due to underpriced Soviet oil), followed by exports and imports of non-food raw materials, imports of fuels (mostly coal), exports of food and raw materials for food (mostly grain), imports of food and raw materials for food (mostly manufactured foodstuffs), imports of industrial consumer goods, exports and imports of machinery and equipment, and finally exports of industrial consumer

Table 1. Estimates of Derived Dollar/Ruble Exchange Rates for Soviet Trade with the CMEA Six (Dollars per One Ruble)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	0.39	0.67	0.90	0.93	0.53	0.75
1961	0.41	0.64	0.85	0.92	0.44	0.71
1962	0.41	0.64	0.78	0.93	0.50	0.68
1963	0.40	0.63	0.74	0.91	0.47	0.64
1964	0.40	0.66	0.83	0.98	0.46	0.67
1965	0.41	0.69	0.88	1.04	0.47	0.71
1966	0.42	0.73	0.91	1.05	0.56	0.73
1967	0.43	0.76	0.85	0.96	0.60	0.71
1968	0.44	0.78	0.86	0.90	0.50	0.71
1969	0.42	0.77	0.91	0.91	0.52	0.72
1970	0.45	0.86	1.08	0.97	0.45	0.82
1971	0.45	1.08	0.97	1.06	0.45	0.82
1972	0.49	1.07	0.97	1.08	0.45	0.82
1973	0.58	1.56	1.29	1.15	0.57	1.06
1974	0.63	3.64	2.04	1.72	0.56	1.75
1975	0.64	2.05	1.44	1.65	0.58	1.34
1976	0.55	2.01	1.33	1.39	0.47	1.25
1977	0.57	1.85	1.36	1.44	0.49	1.23
1978	0.61	1.62	1.39	1.69	0.48	1.19
<u>I m p o r t s</u>						
1960	0.44	0.78	1.07	0.98	0.59	0.66
1961	0.43	0.76	1.01	1.06	0.53	0.65
1962	0.43	0.71	0.98	1.01	0.53	0.61
1963	0.43	0.65	1.03	1.01	0.54	0.62
1964	0.43	0.70	1.07	1.00	0.54	0.62
1965	0.43	0.75	1.02	1.06	0.55	0.63
1966	0.44	0.76	1.04	1.05	0.56	0.63
1967	0.45	0.75	0.97	1.08	0.53	0.62
1968	0.43	0.74	0.96	1.08	0.52	0.60
1969	0.44	0.74	1.01	1.07	0.54	0.62
1970	0.46	0.89	1.08	1.09	0.57	0.65
1971	0.51	1.12	1.04	1.12	0.57	0.68
1972	0.56	0.99	1.02	1.12	0.64	0.72
1973	0.64	1.22	1.31	1.26	0.77	0.84
1974	0.72	1.88	2.02	1.30	0.90	1.03
1975	0.68	1.49	1.51	1.10	0.76	0.89
1976	0.63	1.32	1.31	1.09	0.75	0.82
1977	0.66	1.29	1.32	1.16	0.76	0.84
1978	0.69	1.32	1.34	1.20	0.80	0.85

goods. In view of the fact that the Soviet Union primarily exports relatively underpriced hard (primary) commodities and mostly imports relatively overpriced soft (manufactured) commodities the derived dollar/ruble exchange rate for all exports exceeds that for all imports in every single year during the entire period under study, i.e., 1960-78. The narrowest spread between the two exchange rates occurred in 1963 when it amounted to mere \$0.02; the widest spread occurred in 1974 when the difference amounted to \$ 0.72.

As far as the differences in derived dollar/ruble exchange rates between individual Eastern European countries are concerned, a predictable pattern also emerges. In particular, the higher the share of manufactured commodities in trade (particularly machinery), the lower the derived exchange rate for all goods; the higher the share of primary commodities (particularly fuels in the 1970's), the higher the derived exchange rate. Consequently, on the (Soviet) export side, the derived exchange rate for East Germany is generally the highest, followed by that for Czechoslovakia, Bulgaria, Hungary, Poland, and Romania (which does not import any Soviet oil). On the (Soviet) import side, the derived exchange rate for Bulgaria is the highest, followed by that for Romania, the Czechoslovak rate together with that for East Germany and Poland being virtually indistinguishable, while the Hungarian rate generally appears to be the lowest.

By dividing the official Soviet dollar/ruble exchange rate (see Table 12 in Section VIII below) by the estimates of derived dollar/ruble exchange rates for Soviet exports to and imports from the CMEA Six, we obtain information on the relationship between the price level in Soviet trade with CMEA relative to the wmp level for every commodity category separately for exports

and imports. The results of this calculation are presented in Table 2 and in Figures 1 and 2 below.

The information presented in Table 2 indicates that at official exchange rates the overall Soviet export price level typically exceeded the wmp level, the year 1974 being the only exception. The export price level bias was the highest in 1963 when average Soviet export prices to CMEA exceeded the average level of wmp's by 73 percent; on the other hand in 1974 the average level of Soviet export prices to Eastern Europe was 24 percent below wmp's. As far as Soviet imports from Eastern Europe are concerned, their average price level exceeded the average wmp level between 28 percent (in 1974) and 81 percent (in 1962). The greatest deviation from wmp's on the export side occurred in 1974 when Soviet prices of fuels were 64 percent below wmp's and in 1978 when Soviet prices of industrial consumer goods exceeded the wmp level by 206 percent. On the import side, Soviet prices for non-food raw materials in 1974 were 35 percent below wmp's and prices of machinery and equipment in 1962 exceeded wmp's by 160 percent.

The data presented in Table 2 and Figures 1 and 2 support earlier conclusions by Marer [1972] and other writers, namely that prices of primary commodities in intra-CMEA trade were generally much closer to wmp's than prices of manufactured commodities.³⁹ However, our estimates of the degree of positive deviation of intra-CMEA ftp's of machinery, equipment, and industrial consumer goods greatly exceed those of other writers because in our study we take into account the differences in the quality of manufactured commodities produced within CMEA and in the Developed West. This important adjustment was, to our knowledge, overlooked in all previous studies and it resulted in a serious understatement of the degree of distortions in the intra-CMEA relative price structure.⁴⁰

Table 2. The Ratio of Prices in Soviet Trade with the CMEA Six to World Market Prices at Official Soviet Dollar/Ruble Exchange Rates

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	2.83	1.67	1.24	1.19	2.10	1.49
1961	2.72	1.74	1.30	1.20	2.53	1.57
1962	2.68	1.73	1.42	1.19	2.21	1.64
1963	2.75	1.75	1.50	1.22	2.35	1.73
1964	2.80	1.68	1.34	1.14	2.42	1.66
1965	2.69	1.61	1.26	1.07	2.38	1.56
1966	2.63	1.51	1.23	1.06	1.98	1.52
1967	2.57	1.46	1.31	1.16	1.85	1.56
1968	2.50	1.43	1.29	1.24	2.22	1.57
1969	2.65	1.44	1.22	1.21	2.14	1.54
1970	2.47	1.29	1.03	1.15	2.47	1.35
1971	2.45	1.02	1.15	1.05	2.46	1.36
1972	2.48	1.13	1.24	1.11	2.70	1.48
1973	2.33	0.87	1.05	1.18	2.38	1.28
1974	2.11	0.36	0.65	0.77	2.34	0.76
1975	2.17	0.68	0.96	0.84	2.40	1.03
1976	2.41	0.66	1.00	0.96	2.83	1.06
1977	2.39	0.73	0.99	0.95	2.76	1.10
1978	2.40	0.90	1.05	0.87	3.06	1.23
<u>I m p o r t s</u>						
1960	2.53	1.42	1.04	1.13	1.89	1.68
1961	2.56	1.46	1.10	1.05	2.09	1.70
1962	2.60	1.55	1.13	1.10	2.09	1.81
1963	2.56	1.70	1.08	1.10	2.07	1.80
1964	2.59	1.58	1.04	1.11	2.04	1.78
1965	2.56	1.48	1.09	1.04	2.04	1.77
1966	2.52	1.46	1.07	1.06	2.00	1.76
1967	2.47	1.48	1.15	1.03	2.11	1.80
1968	2.58	1.50	1.16	1.02	2.16	1.86
1969	2.52	1.51	1.10	1.04	2.07	1.80
1970	2.42	1.24	1.03	1.02	1.95	1.70
1971	2.20	0.99	1.07	0.99	1.95	1.63
1972	2.14	1.22	1.18	1.08	1.89	1.68
1973	2.11	1.11	1.04	1.08	1.76	1.62
1974	1.83	0.70	0.65	1.01	1.47	1.28
1975	2.05	0.93	0.92	1.26	1.82	1.55
1976	2.12	1.00	1.01	1.22	1.78	1.62
1977	2.05	1.06	1.03	1.17	1.78	1.61
1978	2.11	1.11	1.09	1.22	1.83	1.73

Figure 1. The Ratio of Prices of Soviet Exports to the CMEA Six to World Market Prices at Official Soviet Dollar/Ruble Exchange Rates

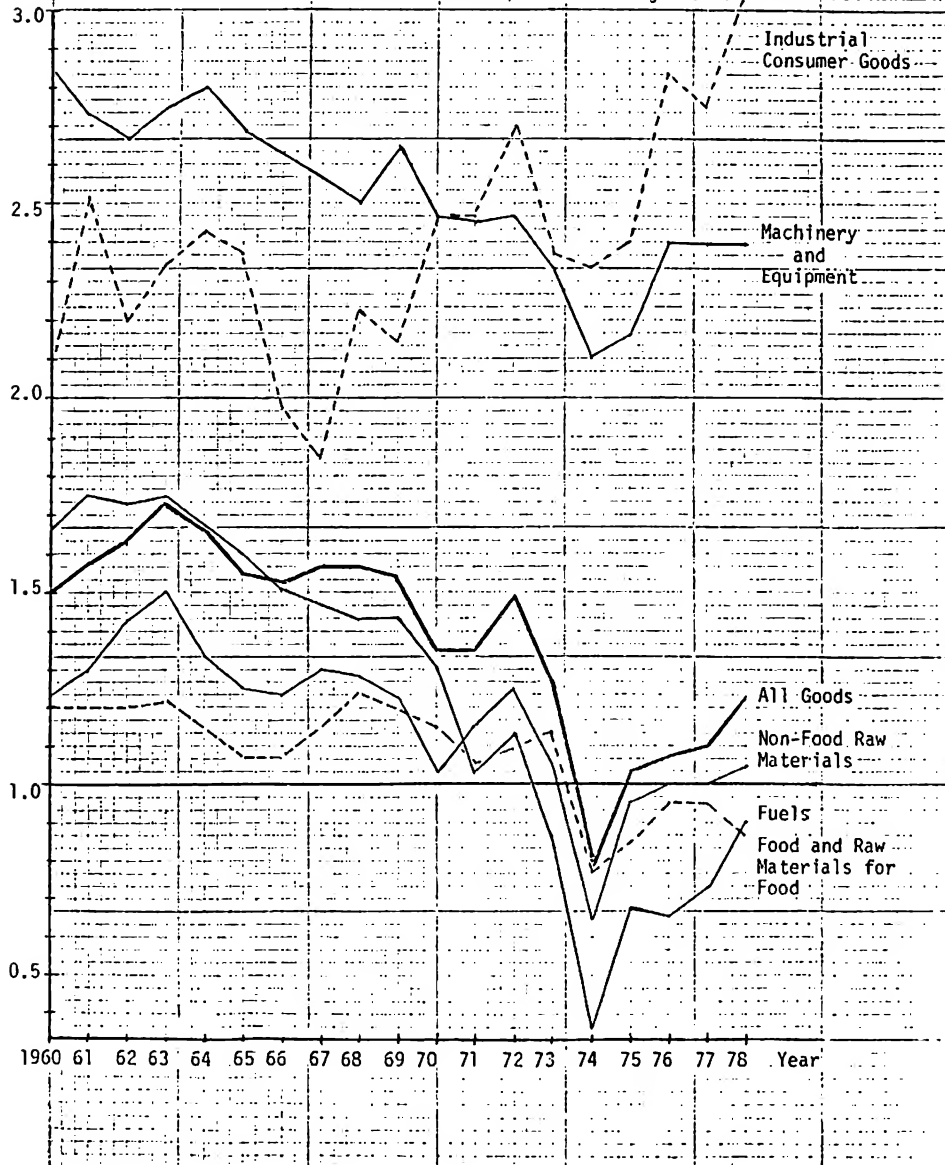
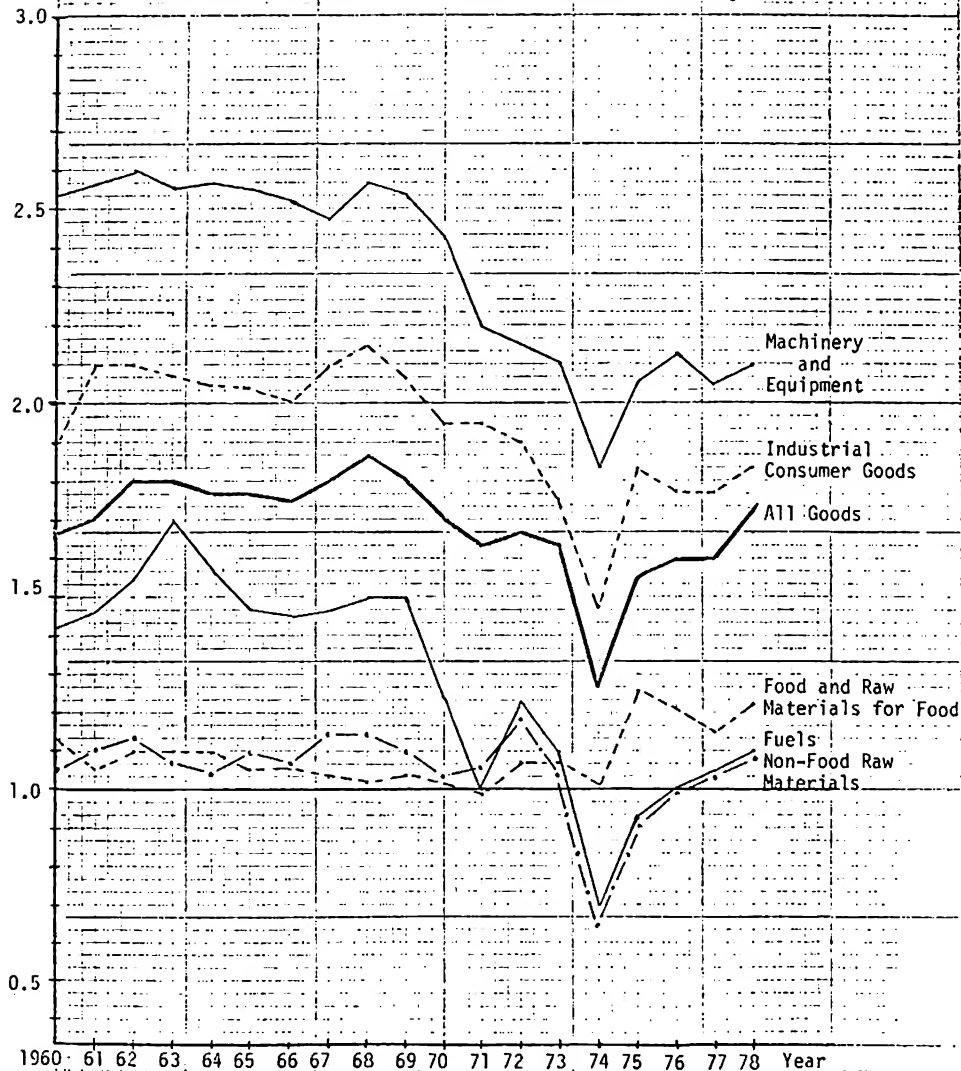


Figure 2. The Ratio of Prices of Soviet Imports from the CMEA Six to World Market Prices at Official Soviet Dollar/Ruble Exchange Rates



VI. Results of the Calculation of Implicit Soviet Trade Subsidies to Eastern Europe

The results of the detailed calculation of implicit Soviet trade subsidies to the CMEA Six measured in current dollars are presented in Table 3 below. Detailed calculation of the implicit trade subsidies for individual Eastern European countries is presented in Tables A-19 through A-24 in Appendix V. The dollar trade balances for individual CMEA countries and for all of Eastern Europe were calculated as the difference between exports and imports measured in dollars and at wmp's which are presented in Tables A-25 through A-31 in Appendix V;⁴¹ the overall ruble trade balances were calculated from the data in Tables A-6 through A-12 in Appendix III.⁴² In addition, in Figure 3 below, we depict the trends in the Soviet commodity trade balances as well as the overall trade balance with the CMEA Six measured in current dollars and at wmp's for the period 1960-78. In Figure 4 the trend in the overall implicit Soviet trade subsidy to Eastern Europe is compared with the trend in Soviet imports of machinery and equipment from the Developed West and with the overall Soviet dollar trade deficit with the Developed West.

Our calculations show that the size of implicit Soviet trade subsidies granted to Eastern Europe exhibits large variations over time; the subsidies, measured in current dollars, reached their lowest level in 1963 (96 million dollars) and the highest level was reached in 1974 (6265 million dollars). It appears that the increases in the subsidies over time coincide with three events, namely the intra-CMEA ftp revision of 1964-65, a temporary surge in wmp's of primary commodities in 1970-71, and the increase in wmp's of fuels in 1973-74 through the rest of the period under study. Five different phases in the level of implicit trade subsidies can be recognized. During the first phase (1960-64), the subsidies averaged about 186 million dollars annually.

Table 3. Calculation of the Implicit Trade Subsidies Granted by the Soviet Union to the CMEA Six
(in Millions of Current Dollars)

Year	Machinery Trade Balance	Fuel Trade Balance	Non-Food Raw Material Trade Balance	Food Trade Balance	Industrial Consumer Goods Trade Balance	Total Trade Balance	Total Ruble Balance Converted Into Dollars	Implicit Trade Subsidy
1960	-258	101	513	276	-235	397	154	243
1961	-199	148	546	130	-250	375	191	184
1962	-259	222	508	277	-306	443	208	235
1963	-348	272	397	187	-399	109	13	96
1964	-352	331	612	24	-405	211	38	173
1965	-406	341	801	-35	-408	294	-75	369
1966	-289	365	919	33	-468	560	127	434
1967	-354	401	845	35	-534	393	-33	427
1968	-322	471	1000	-10	-582	557	2	555
1969	-397	543	1155	6	-623	683	99	585
1970	-457	659	1757	-132	-741	1086	49	1037
1971	-592	944	1525	-109	-895	883	-29	912
1972	-976	1053	1448	-470	-1078	-23	-685	662
1973	-1147	1770	2208	-516	-1281	1034	-594	1628
1974	-1223	5335	4077	-305	-1519	6366	101	6265
1975	-1517	5782	3809	-698	-1578	5797	472	5325
1976	-1638	6922	3786	-1094	-1666	6311	714	5596
1977	-2022	8120	4060	-1113	-1918	7128	1190	5938
1978	-3491	8487	4465	-1296	-2265	5900	146	5754

Note: Total Trade Balance = Sum of Commodity Trade Balances Measured at World Market Prices;
Implicit Trade Subsidy = Total Trade Balance minus Total Ruble Trade Balance Converted into Dollars.

Figure 3. Soviet Commodity Trade Balances and Overall Trade Balance with the CMEA Six Valued at World Market Prices (in Millions of Current Dollars)

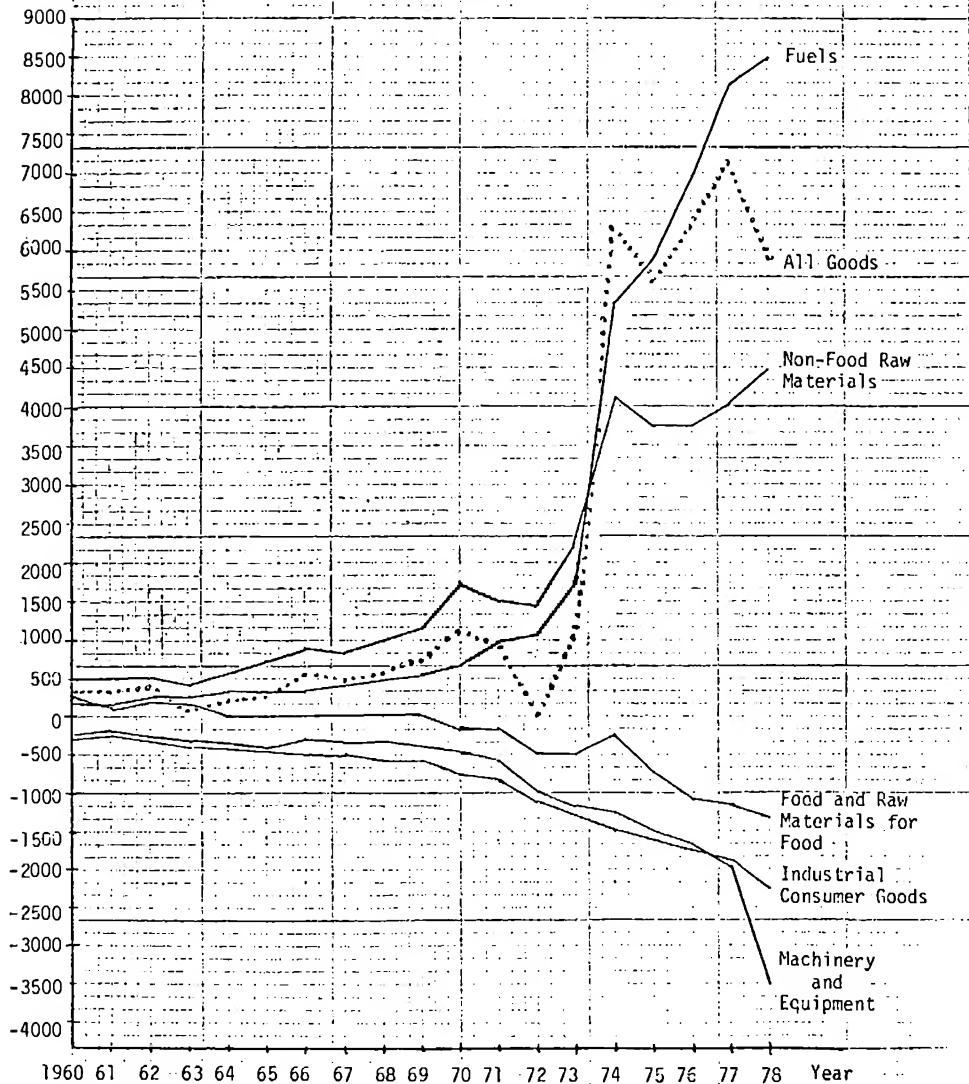
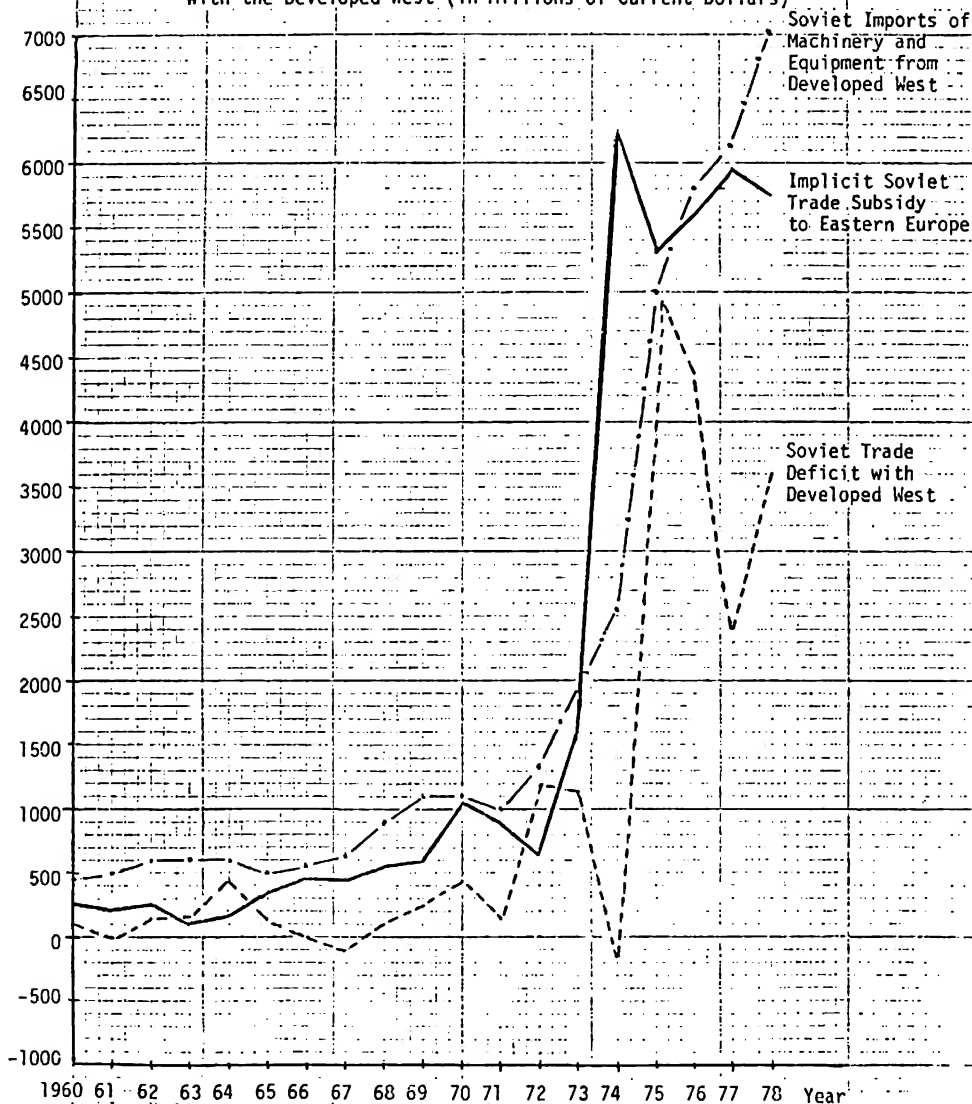


Figure 4. Implicit Soviet Trade Subsidy to Eastern Europe Compared to Soviet Machinery Imports from the Developed West and Soviet Trade Deficit with the Developed West (in Millions of Current Dollars)



During the second phase, after the 1964-65 intra-CMEA ftp revision took place, the subsidies averaged about 474 million dollars annually due to the deterioration in the Soviet terms of trade with Eastern Europe vis-à-vis the trends in relative wmp's.⁴³ As a result of the temporary surge in wmp's of primary commodities in 1970-71, the average level of implicit subsidies reached about 975 million dollars annually during the third phase (1970-71). In 1972 and probably throughout most of 1973 these subsidies were in the 600 to 800 million dollar range; thus during the fourth phase (1972-73) the subsidies were close to the trend line observed during the period 1965-69. The rapid growth of wmp's of fuels in late 1973 and in 1974 pushed the level of subsidies to about 1628 million dollars in 1973 and to an average annual level of about 5776 million dollars during the fifth phase (1974-78). It is interesting to note that the 1975 intra-CMEA ftp reform did not significantly reduce the level of the subsidies below the all-time high value of 6265 million dollars reached in 1974 in spite of the fact that Soviet prices of fuel exports to Eastern Europe increased by about 85 percent relative to 1974.⁴⁴

Figure 4 is of interest because it indicates the size of the subsidies in relative terms by comparing their magnitude to the size of Soviet imports of machinery and equipment from the Developed West and to the overall Soviet trade deficit with the Developed West. During 1960-78, the undiscounted cumulative subsidies in current dollars amounted to about 36.4 billion dollars; on the other hand, the undiscounted Soviet cumulative imports of machinery and equipment from the Developed West in current dollars amounted to 38.4 billion dollars, and the overall Soviet cumulative deficit with the Developed West amounted to about 19.4 billion dollars.⁴⁵ This, however, should not be

interpreted as suggesting that the Soviet Union, by eliminating the subsidies, could have doubled its imports of machinery and equipment from the Developed West or could have achieved a 17 billion dollar surplus with the Developed West instead of a deficit of 194 billion. Any elimination of subsidies would have required a substantial increase in Soviet defense expenditure both at home and abroad in order to maintain the same level of security because Soviet subsidies have generated increased allegiance in Eastern Europe which is one of the inputs in the Soviet security production function.

While the trend in implicit Soviet trade subsidies to the CMEA Six taken together is not that surprising, the distribution of implicit subsidies among individual Eastern European countries seems to be startling in several respects. Different measures of the distribution of implicit subsidies during 1960-78 are presented in Table 4 below. Table 4 consists of three parts: estimates of subsidies measured in current dollars, then estimates of the size and distribution of these subsidies measured in constant 1970 dollars, and finally the present value of implicit subsidies in 1980 dollars. In addition, the trend in implicit subsidies measured in current dollars is illustrated in Figure 5, while the trend in subsidies measured in constant 1970 dollars is illustrated in Figure 6.

An estimate of subsidies in constant 1970 dollars is included because it is a better indicator of the extent of Soviet transfer of real resources to Eastern Europe than the estimate in current dollars. The overall Soviet import price index from the Developed West was selected as a deflator because the authors judged it to be a good measure of the changing opportunity cost of a forgone dollar of export earnings in and hence also of imports from the Developed West.⁴⁶ Present value of implicit subsidies in 1980 dollars was

Table 4. The Distribution of Implicit Soviet Trade Subsidies Among Individual Eastern European Countries (in Millions of Dollars)

Year	Bulgaria	Czecho- slovakia	East Germany	Hungary	Poland	Romania	CMEA Six
<u>In Current Dollars</u>							
1960	-77.5	67.4	178.7	46.5	52.9	-24.7	243.4
1961	-72.7	48.8	171.5	64.6	16.2	-44.2	184.1
1962	-60.5	60.9	212.0	48.0	33.2	-58.5	235.2
1963	-112.8	37.3	158.1	40.5	28.8	-56.3	95.6
1964	-101.7	46.0	242.0	35.2	-1.9	-46.5	173.0
1965	-73.1	92.4	302.9	52.7	13.1	-19.2	368.7
1966	-96.0	108.9	321.9	56.3	70.5	-27.9	433.7
1967	-91.2	124.3	260.9	62.3	95.6	-25.4	426.5
1968	-89.2	162.5	288.1	98.5	110.2	-15.3	554.8
1969	-54.8	163.3	282.3	93.4	124.1	-23.4	584.9
1970	6.0	203.1	466.7	158.1	169.5	33.4	1036.7
1971	-14.7	157.7	425.1	142.1	164.7	36.6	912.5
1972	-32.6	109.1	329.6	112.6	131.0	11.9	661.7
1973	159.8	250.3	688.9	226.8	300.4	1.8	1628.2
1974	1081.3	1174.2	2022.6	876.9	1067.1	42.9	6264.9
1975	919.3	1096.9	1665.0	597.9	1027.3	19.1	5325.5
1976	876.8	1195.4	1786.4	671.1	1021.4	45.4	5596.3
1977	1014.8	1225.5	1895.0	644.6	1105.3	50.4	5937.6
1978	1087.1	1086.4	1913.9	660.6	897.0	109.1	5754.1
<u>In Constant 1970 Dollars</u>							
1960	-76.7	66.7	177.0	46.0	52.4	-24.4	241.0
1961	-75.7	50.8	178.6	67.3	16.8	-46.1	191.8
1962	-65.1	65.5	228.0	51.7	35.7	-62.9	252.9
1963	-118.7	39.3	156.4	42.7	30.3	-59.2	100.7
1964	-102.7	46.5	244.4	35.5	-1.9	-47.0	174.7
1965	-73.9	93.3	305.0	53.2	13.3	-19.4	372.5
1966	-96.0	108.9	321.9	56.3	70.5	-27.9	433.7
1967	-94.0	128.2	269.0	64.2	98.5	-26.2	439.7
1968	-94.9	172.9	306.5	104.8	117.2	-16.3	590.2
1969	-57.0	170.1	294.0	97.3	129.2	-24.4	609.2
1970	6.0	203.1	466.7	158.1	169.5	33.4	1036.7
1971	-14.0	150.2	405.8	135.3	156.9	34.8	869.0
1972	-29.9	100.1	302.4	103.3	120.2	10.9	607.0
1973	120.2	182.2	517.9	170.6	225.9	1.4	1224.2
1974	578.2	627.9	1081.6	468.9	570.6	23.0	3350.2
1975	442.0	527.4	800.5	287.4	493.9	9.2	2560.3
1976	447.3	609.9	911.4	342.4	521.1	23.1	2855.3
1977	490.2	592.0	915.9	311.4	534.5	24.3	2858.4
1978	485.3	485.0	854.4	294.9	400.4	48.7	2568.8

Table 4 Continued

Year	Bulgaria	Czecho- slovakia	East Germany	Hungary	Poland	Romania	CMEA Six
<u>Present Value of Implicit Subsidies in 1980 Dollars</u>							
1960	-278.7	242.3	643.0	167.2	190.4	-88.7	875.5
1961	-251.0	168.6	592.1	223.0	55.8	-152.7	635.8
1962	-201.9	203.2	707.0	160.2	110.7	-195.0	784.2
1963	-362.5	119.8	508.0	130.3	92.4	-180.8	307.3
1964	-314.5	142.2	748.2	108.8	-6.0	-143.9	534.8
1965	-216.6	273.5	897.0	156.0	38.9	-56.8	1092.0
1966	-270.9	307.3	908.6	159.0	199.0	-78.8	1224.2
1967	-242.2	330.2	693.0	165.4	253.9	-67.4	1132.9
1968	-224.7	409.3	725.6	248.0	277.5	-38.5	1397.2
1969	-129.7	386.6	668.4	221.2	293.8	-55.4	1385.0
1970	13.0	438.2	1006.9	341.1	365.6	72.0	2236.7
1971	-29.3	313.6	847.1	282.5	327.4	72.7	1814.1
1972	-60.8	203.5	614.9	210.0	244.4	22.2	1234.2
1973	282.7	442.8	1218.5	401.2	531.4	3.2	2879.9
1974	1750.8	1901.2	3275.0	1419.8	1727.8	69.5	10144.1
1975	1340.9	1600.0	2428.6	872.0	1498.4	27.9	7767.7
1976	1194.9	1629.2	2434.6	914.6	1392.0	61.8	7627.2
1977	1310.0	1581.9	2447.6	832.2	1428.2	65.0	7664.8
1978	1323.5	1322.7	2330.1	804.3	1092.1	132.9	7005.6
est.1979	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	10692.2
est.1980	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	19960.0

Note: Estimates of the present value of implicit subsidies in 1980 dollars for years 1979 and 1980 are based on conclusions from Section VII below.

Figure 5: The Trend in Implicit Soviet Trade Subsidies Granted to Individual Eastern European Countries (in Millions of Current Dollars)

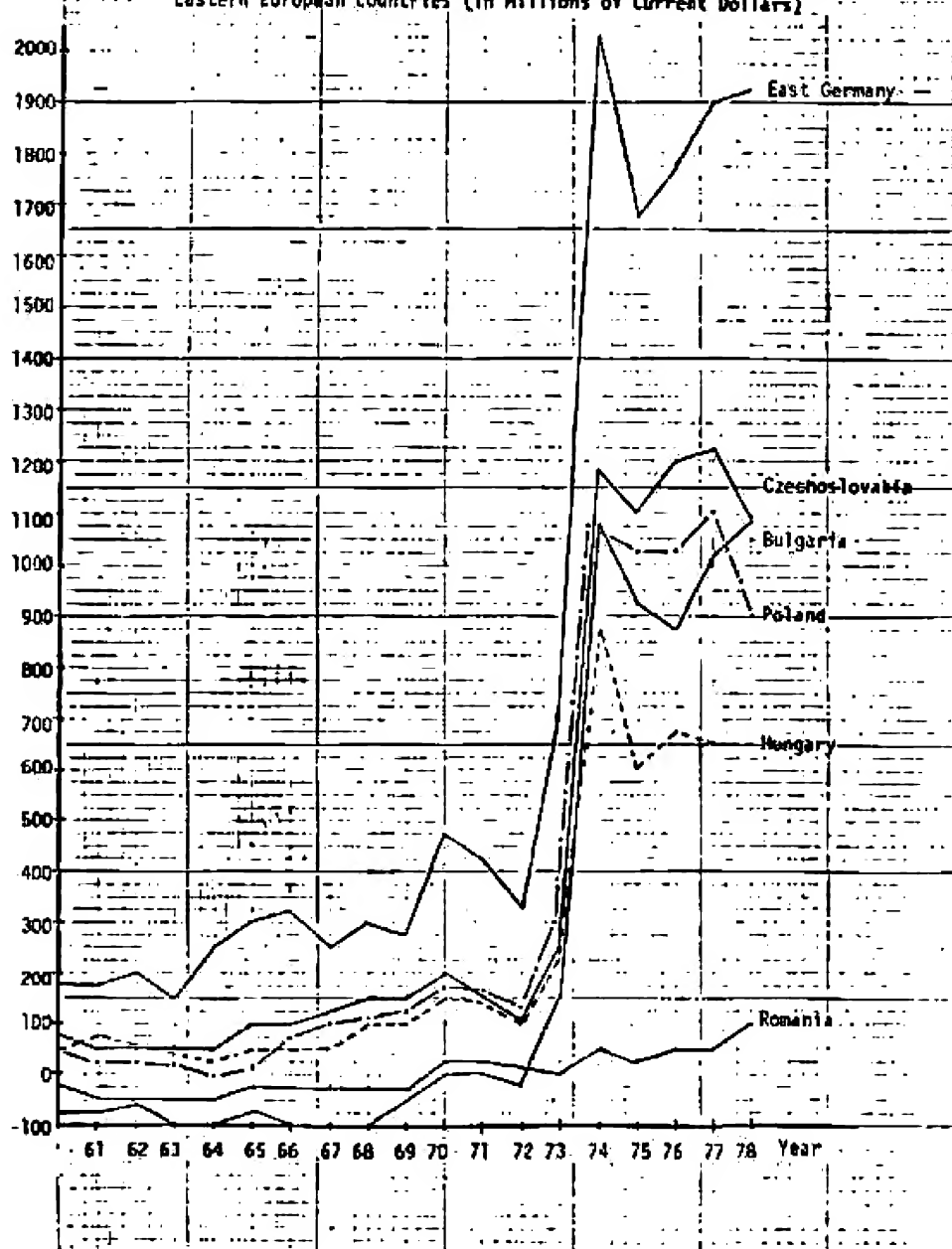
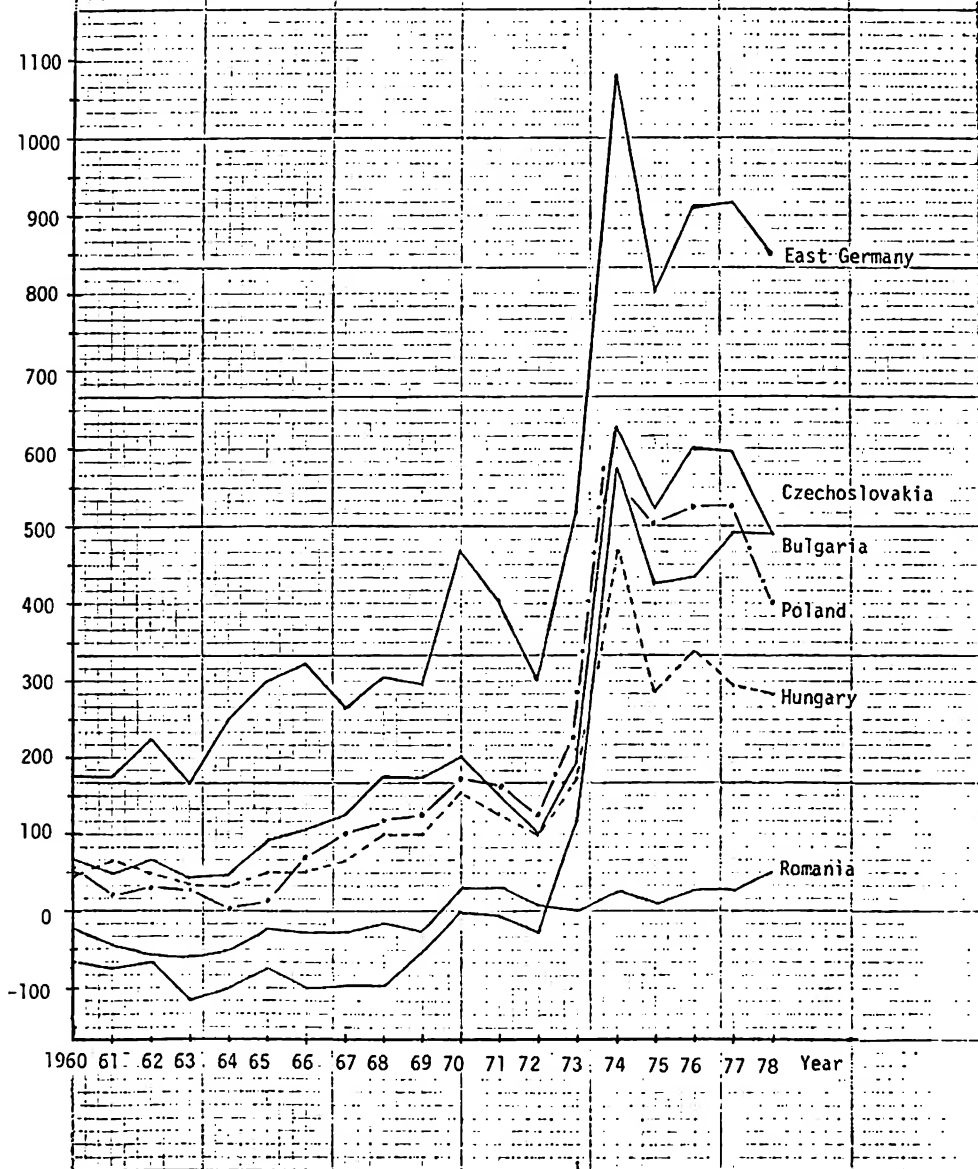


Figure 6. The Trend in Implicit Soviet Trade Subsidies Granted to Individual Eastern European Countries (in Millions of 1970 Dollars)



calculated using the discount rates based on annual averages of 3-month Euro-dollar loan interest rates.⁴⁷

The surprising finding in Table 4 is that in the case of Bulgaria during 1960-69 and 1971-72, and in the case of Romania during 1960-69, the implicit trade subsidies were negative, i.e., Bulgaria and Romania paid implicit trade taxes to the Soviet Union.⁴⁸ Only since 1973 has the Soviet trade treatment of Bulgaria been very similar to that of the rest of Eastern Europe with the exception of Romania. While Romania began to receive implicit Soviet trade subsidies in 1970, the magnitude of these subsidies during 1970-78 was negligible relative to the scale of subsidies granted to Eastern Europe especially during the post-1974 period.

Tables 5 through 10 analyze the distribution of subsidies among individual Eastern European countries. Instead of looking at individual years, in Tables 5 - 10 we concentrate on four subperiods (1960-64, 1965-69, 1970-73, 1974-78) and then on the entire 19-year period under study (1960-78). The first period (1960-64) occurred between the 1958 and 1964-65 intra-CMEA ftp revisions. The second period (1964-69) took place between the 1964-65 price revision and the temporary surge in wmp's of primary commodities in the early 1970's. The third period (1970-73) was a transitional period prior to the explosion of wmp's of fuels and other primary commodities. The last period (1974-78) was characterized by a dramatic increase in wmp's of fuels and other primary commodities relative to wmp's of manufactured commodities.

In Table 5 the ratio of implicit Soviet trade subsidies to individual CMEA countries to total Soviet exports to these countries is presented. The first important finding is that for the CMEA Six as a group this ratio has

Table 5. The Ratio of Implicit Soviet Trade Subsidies to Total Soviet Exports to Individual CMEA Countries (Annual Averages in Percent)

Period	Bulgaria	Czecho-slovakia	East Germany	Hungary	Poland	Romania	CMEA Six
1960-64	-38.2	11.1	22.2	20.2	7.5	-23.5	8.1
1965-69	-19.1	19.5	27.2	18.5	13.9	-5.9	14.0
1970-73	2.1	16.6	27.9	20.7	13.7	5.9	17.7
1974-78	33.9	36.2	40.0	31.6	30.8	6.5	33.8

Table 6. Implicit Soviet Trade Subsidies to Individual CMEA Countries in Constant 1970 Dollars (Period Sums in Millions of Dollars)

1960-64	-438.9	268.8	994.4	243.2	133.3	-239.6	961.1
1965-69	-415.8	673.4	1497.4	375.8	428.7	-114.2	2445.3
1970-73	82.3	641.6	1692.8	567.3	672.5	80.5	3736.9
1974-78	2443.0	2842.2	4563.8	1705.0	2520.5	128.3	14203.0
1960-78	1670.6	4426.0	8748.4	2891.3	3755.0	-145.0	21346.3

Table 7. Country Shares in Implicit Soviet Trade Subsidies Measured in Constant 1970 Dollars (in Percent)

1960-64	-45.7	28.0	103.5	25.3	13.8	-24.9	100.0
1965-69	-17.0	27.5	61.2	15.4	17.5	-4.6	100.0
1970-73	2.2	17.2	45.3	15.2	18.0	2.1	100.0
1974-78	17.2	20.0	32.1	12.0	17.8	0.9	100.0
1960-78	7.8	20.7	41.0	13.6	17.6	-0.7	100.0

Table 8. Per Capita Average Annual Implicit Soviet Trade Subsidies to Individual CMEA Countries (in Constant 1970 Dollars)

1960-64	-10.3	3.8	11.7	4.9	0.8	-2.4	1.9
1965-69	-9.8	11.7	17.6	7.5	2.6	-1.1	4.7
1970-73	2.4	11.2	24.8	14.2	5.2	1.0	9.1
1974-78	57.6	39.7	53.5	34.1	15.5	1.3	27.6
1960-78	10.4	16.3	27.0	15.2	6.1	-0.4	10.9

Table 9. Present Value of Implicit Soviet Trade Subsidies to Individual CMEA Countries in 1980 Dollars (Period Sums in Millions of Dollars)

Period	Bulgaria	Czecho-slovakia	East Germany	Hungary	Poland	Romania	CMEA Six
1960-64	-1408.6	876.1	3198.3	789.5	443.3	-761.1	3137.6
1965-69	-1084.1	1706.9	3892.6	949.6	1063.1	-296.9	6231.3
1970-73	205.6	1398.1	3687.4	1234.8	1468.8	170.1	8164.9
1974-78	6920.1	8035.0	12915.9	4842.9	7138.5	357.1	40209.4
1960-78	4633.0	12016.1	23694.2	7816.8	10113.7	-530.8	57743.2
est.1960-80	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	88395.4

Table 10. Present Value of Per Capita Average Annual Implicit Soviet Trade Subsidies to Individual CMEA Countries (in 1980 Dollars)

1960-64	-33.2	12.2	37.5	15.8	2.7	-7.5	6.1
1965-69	-25.5	23.8	45.6	19.0	6.5	-2.9	12.1
1970-73	6.1	24.4	54.0	30.9	11.3	2.1	19.8
1974-78	163.0	112.1	151.4	96.9	43.9	3.5	78.1
1960-78	28.7	44.1	73.1	41.1	16.4	1.4	29.5

Note: Estimates of the present value of implicit subsidies in 1980 dollars for years 1979 and 1980 in Table 9 are based on conclusions from Section VII below.

been steadily increasing, rising from 8 percent in the early 1960's to almost 34 percent during 1974-78. Thus the burden of these subsidies on the Soviet economy has been steadily rising over time. Focusing on the last period (1974-78), this ratio is the highest for East Germany, followed by Czechoslovakia, Bulgaria, Hungary, Poland, and finally Romania.

Absolute amounts of Soviet subsidies in constant 1970 dollars for the four subperiods analyzed are listed in Table 6. Once again focusing on the last period (1974-78), the descending ranking of countries with respect to the absolute size of the subsidies is: East Germany, Czechoslovakia, Poland, Bulgaria, Hungary, and Romania. The ranking for 1960-78 is the same except that Bulgaria and Hungary switch positions.

Individual country shares in total implicit Soviet trade subsidies in constant 1970 dollars appear in Table 7. During 1974-78, East Germany received about 32 percent of total Soviet subsidies to all of Eastern Europe, followed by Czechoslovakia (20 percent), Poland (18 percent), Bulgaria (17 percent), Hungary (12 percent), and Romania (1 percent). The Soviet preferential trade treatment of East Germany is even more dramatic when we look at the entire 1960-78 period; during these years East Germany's share amounted to 41 percent. On the other hand, the Bulgarian share during the entire 1960-78 period is less than 8 percent, owing to large implicit Soviet trade taxes imposed on Bulgaria during 1960-69. The shares of the remaining countries during the entire period are very similar to those during the 1974-78 subperiod.

One drawback of Tables 5, 6, and 7 is that these tables do not take into account the size of individual CMEA countries. Employing the 1970

population of each country as a proxy for size,⁴⁹ in Table 9 we present the estimates of per capita average annual implicit Soviet trade subsidies to individual CMEA countries in 1970 dollars. During 1974-78, the annual average per capita subsidies turn out to be the highest for Bulgaria (58 dollars per person per year), followed by East Germany (54 dollars), Czechoslovakia (40 dollars), Hungary (34 dollars), Poland (15 dollars), and Romania (1 dollar). The dramatic rise in Soviet subsidies over time is especially apparent from the data in the last column of Table 8. While during 1960-64 the subsidies amounted to about 2 dollars a year per person in Eastern Europe, during 1965-69 this amount increased to almost 5 dollars, it reached 9 dollars during 1970-73, and then tripled again, reaching almost 28 dollars per person a year during 1974-78.

Table 9 presents information on the present value of implicit Soviet trade subsidies to individual CMEA countries in 1980 dollars. The advantage of forward discounting of subsidies is that we are able to say how much resources in terms of 1980 dollars, inclusive of compound interest, the Soviet Union transferred to individual Eastern European countries. The present value of implicit Soviet trade subsidies to the CMEA Six during 1960-78 is about 57.7 billion dollars, of which 23.7 billion dollars was granted to East Germany, 12.0 billion dollars to Czechoslovakia, 10.1 billion dollars to Poland, 7.8 billion dollars to Hungary, and 4.6 billion dollars to Bulgaria. In the case of Romania, the implicit trade taxes charged by the Soviet Union, amounting close to 1.0 billion dollars during 1960-69, more than offset the implicit subsidies of about 0.5 billion during 1970-78; consequently, over the entire period 1960-78 the Soviet Union imposed net implicit trade taxes on Romania amounting to about 0.5 billion dollars. If we take into account

the dramatic growth in Soviet subsidies to Eastern Europe in 1979 and 1980 (see Section VII below), the present value of implicit Soviet trade subsidies to the CMEA Six during 1960-80 reaches 88.4 billion dollars.

The last table presented above, Table 10, contains information on the present value of per capita average annual implicit subsidies in 1980 dollars and it serves to supplement the information already presented in Tables 8 and 9.

What are the conclusions that emerge from Tables 5 through 10? First of all, it is clear that in absolute terms the Soviet Union has always subsidized East Germany to a greater degree than any other CMEA economy. The next most subsidized country has been Czechoslovakia, followed by Poland, Hungary, Bulgaria, and Romania. However, in the case of Bulgaria, there was a dramatic increase in the amount of absolute subsidies granted by the Soviet Union since 1974, resulting in a change from the initial ranking of Bulgaria and Hungary for the 1974-78 period. Given the dramatic growth of implicit subsidies granted to Bulgaria, it is quite possible that by 1979 Bulgaria may have even surpassed Poland and moved very close to Czechoslovakia.

On the other hand, as far as the amount of implicit subsidies in relative terms (with respect to the size of the country approximated by her 1970 population) is concerned, the ranking of countries that emerges is somewhat different from the one given above. During 1960-78 East Germany and Czechoslovakia still appear to have been the most subsidized economies even in relative terms, but Hungary and Bulgaria appear to have received considerably more in relative terms than Poland, which is by far the largest Eastern European country in terms of population. Romania, just as before, ranks as the least subsidized country. The most important development that took place

during 1974-78 is the spectacular increase in relative subsidies granted to Bulgaria; as a result of the growth in these subsidies, during the latter half of the 1970's Bulgaria appears to be the most subsidized Eastern European economy in relative terms, surpassing even the East German economy.

It is beyond the scope of this paper to try to explain what determines the distribution of implicit Soviet trade subsidies to individual Eastern European countries. This is in fact the topic covered in Marrese and Vaňous [1980c] where the authors analyze the role of country size, strategic aspects of geographic location, a country's value to the USSR as an economic asset (e.g., due to her ability to produce machinery and equipment of above-average quality within CMEA), political considerations, etc., as determinants of the allocation of these subsidies.

VII. Prospects for the Growth of the Implicit Soviet Trade Subsidies to Eastern Europe in 1979 and 1980

Our calculation of implicit Soviet trade subsidies to Eastern Europe ends in 1978. Readers may be curious as to what happened to the magnitude of the subsidies in 1979 and is likely to happen in 1980. After the four-fold increase in wmp's of fuels in 1974, the subsidies increased from about 1628 million dollars in 1973 to about 6265 million dollars in 1974 -- about 3.85 times. In view of a 50 percent increase in the wmp's of oil in 1979 relative to 1978 and an additional 100 percent increase in 1980, bringing the 1980 level of wmp's of oil to about two-and-half times their 1978 level, the magnitude of Soviet subsidies must have risen dramatically. The growth of subsidies is inevitable because the intra-CMEA ftp formula is based on a five-year moving average of wmp's. In addition, the Soviet Union may not even desire to increase its prices of exported fuels as much as is allowable by the formula in order to avoid putting more pressure on the already strained economies of Eastern Europe.⁵⁰

Table 11 below contains our projections of all data needed to calculate the size of 1979 and 1980 subsidies. On the basis of the projected data on Soviet exports, imports, and derived dollar/ruble exchange rates, we estimate that implicit Soviet trade subsidies in 1979 will be about 9550 million dollars, and in 1980 about 19960 million dollars.⁵¹ These are truly staggering magnitudes; the level of subsidies in 1979 corresponds to approximately 47 percent of total Soviet imports from the Developed West in that year, and in 1980 it may reach as much as 85 percent of these imports.

The trend in the level of commodity trade balances measured in dollars

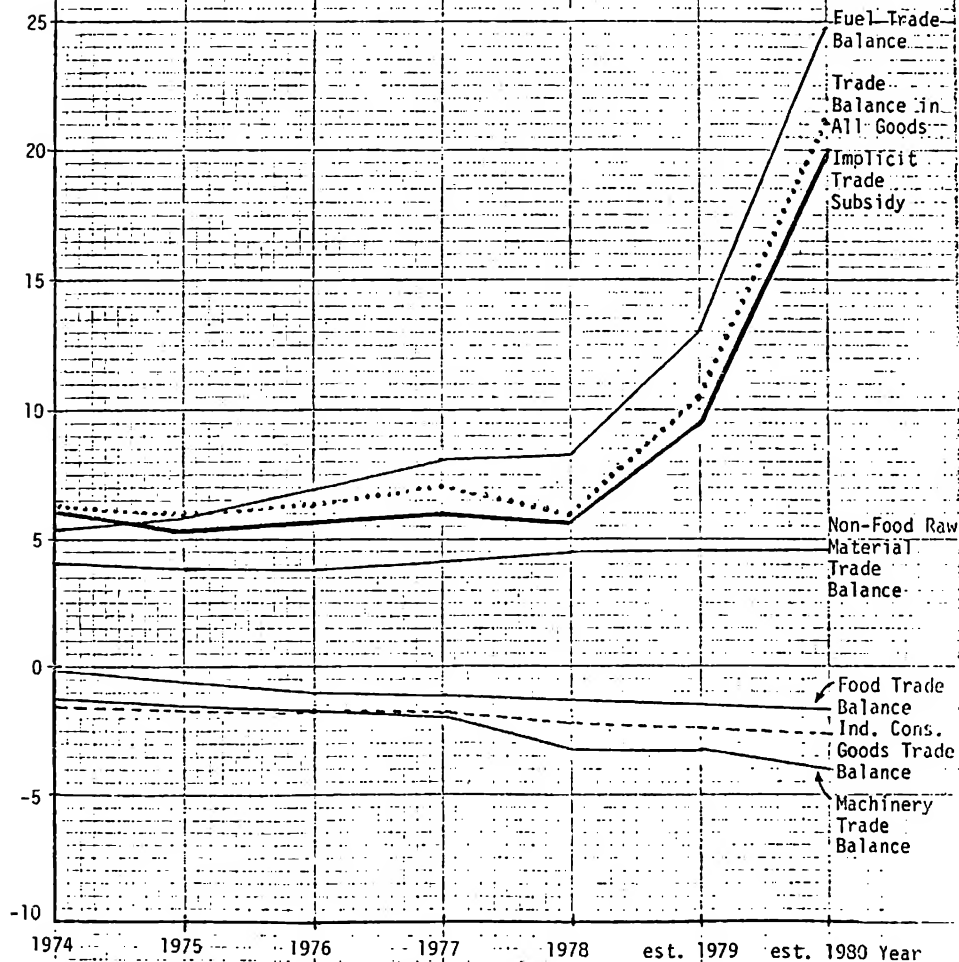
Table 11. Authors' Projections of the Data Needed for the Calculation of the Size of Implicit Soviet Trade Subsidies to Eastern Europe in 1979 and 1980

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>Projected Soviet Exports to Eastern Europe</u>						
(in millions of current rubles)						
1979	6230	6500	5250	100	470	18550
1980	6850	8000	5540	100	510	21000
<u>Projected Soviet Imports from Eastern Europe</u>						
(in millions of current rubles)						
1979	10400	450	2060	1370	3200	17480
1980	11730	510	2320	1540	3600	19700
<u>Projected Dollar/Ruble Exchange Rate for Soviet Exports to Eastern Europe (Dollars per 1 Ruble)</u>						
1979	0.61	2.12	1.39	1.69	0.48	1.36
1980	0.61	3.21	1.39	1.69	0.48	1.81
<u>Projected Dollar/Ruble Exchange Rate for Soviet Imports from Eastern Europe (Dollars per 1 Ruble)</u>						
1979	0.69	1.52	1.34	1.20	0.80	0.85
1980	0.69	1.91	1.34	1.20	0.80	0.86
<u>Projected Soviet Exports to Eastern Europe</u>						
(in millions of current dollars)						
1979	3800	13780	7300	170	230	25280
1980	4180	25680	7700	170	250	37980
<u>Projected Soviet Imports from Eastern Europe</u>						
(in millions of current dollars)						
1979	7180	680	2760	1640	2560	14820
1980	8090	970	3110	1850	2880	16900
<u>Projected Soviet Trade Balance with Eastern Europe</u>						
(in millions of current dollars)						
1979	-3380	13100	4540	-1470	-2330	10460
1980	-3910	24710	4590	-1680	-2630	21080

and at wmp's together with the overall trade balance and implicit trade subsidies for 1974-80 is depicted in Figure 7 below. It is readily apparent from Figure 7 that the key determinant of the level of implicit trade subsidies is the level of the Soviet fuel trade balance (measured in dollars and at wmp's) with Eastern Europe. This relationship can be expected to hold in the future under the following two conditions: (i) that the intra-CMEA ftp formula remains unchanged, and (ii) that wmp's of fuels continue to rise at least as rapidly as overall wmp's.

Since it is doubtful that the estimated 1980 level of Soviet subsidies represents the desired level of these subsidies, we should not be surprised if the Soviet Union responds to the 1979-80 oil price developments in 1981 the way it responded to the 1974 increase in oil prices in 1975. In order to hold the level of subsidies closer to the desired level and reduce the size of the unintended subsidies due to institutional/pricing rigidities within CMEA, the Soviet Union introduced a new formula for calculating intra-CMEA ftp's in 1975.⁵² Because from the Soviet Union's point of view the 1975 formula has not worked as satisfactorily as originally expected, it is possible that the Soviet Union may demand its modification in 1981. We feel that the most likely "improvement" to be demanded by the Soviet Union would be to reduce the lagged five-year moving average of wmp's currently used as a base for the calculation of intra-CMEA ftp's to a three-year moving average of wmp's.⁵³ Alternatively, the Soviet Union may become even more insistent that any increases in Soviet oil deliveries will have to be priced at the wmp level and paid for in convertible currencies.⁵⁴

Figure 7. The Trend in the Soviet Commodity Trade Balances, Overall Trade Balance, and the Level of Implicit Subsidies in Trade with the CMEA Six During 1974-80 Valued at World Market Prices (in Billions of Current Dollars)



VIII. Evidence on the "Realistic" Dollar/Ruble Exchange Rate

Several writers have asserted that at official exchange rates the ruble is greatly overvalued vis-à-vis the dollar.⁵⁵ A few authors have even tried to make some adjustments for the overvaluation of the ruble in their empirical studies of intra-CMEA trade, but these were generally met with scepticism on the part of specialists on centrally planned economies.⁵⁶ Most writers still rely on economically meaningless official exchange rates whenever they work with foreign trade statistics of CMEA countries and simply ignore the aggregation problems that result from the use of overvalued official ruble or national devisa currency exchange rates. They persist in this practice even though it has been abandoned quite a while ago by Eastern European economists in their studies intended for internal use and it is being abandoned now in several Eastern European countries even in official publications.⁵⁷

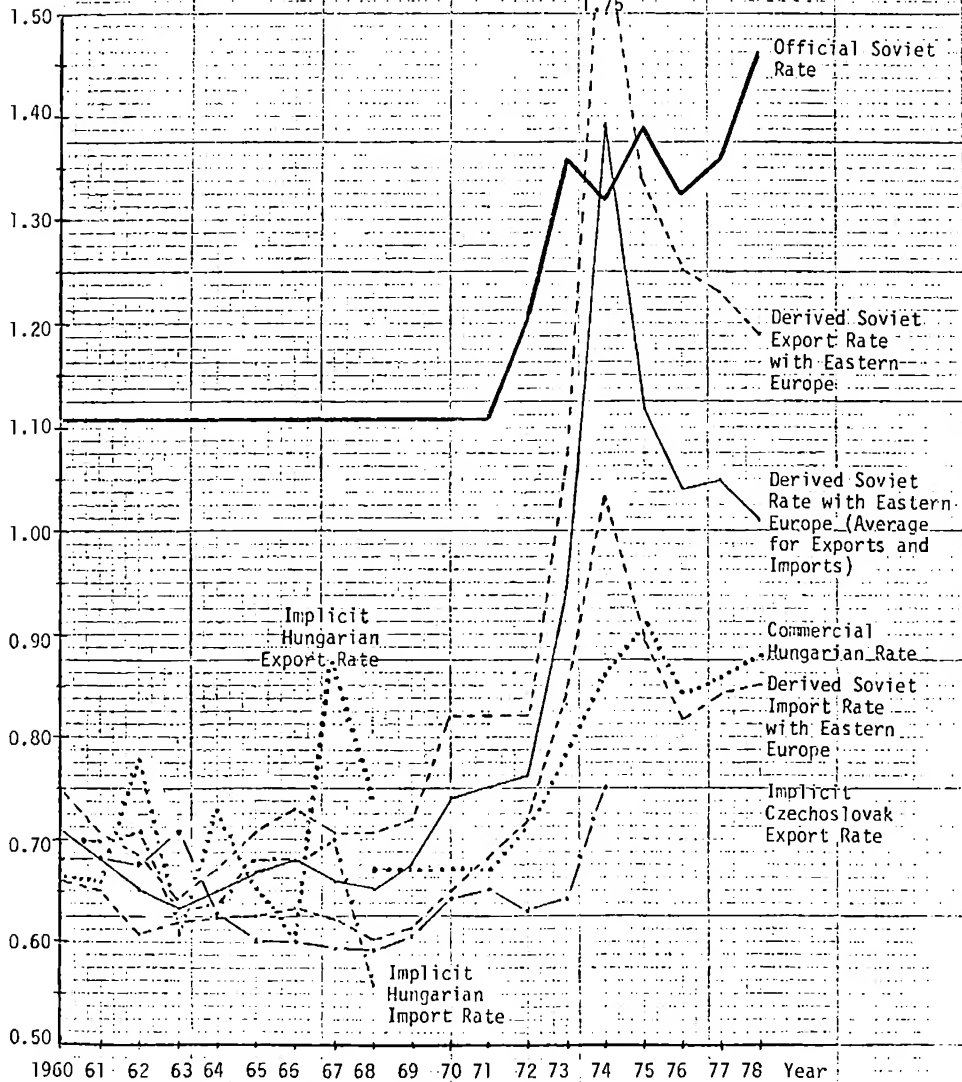
In Table 12 and Figure 8 below we present the official Soviet dollar/ruble exchange rate (also the official CMEA dollar/ruble exchange rate until 1972); derived Soviet export, import, and average dollar/ruble rates for trade with Eastern Europe; the Hungarian commercial rate as well as the implicit export and import rates in use until 1967/68; and the implicit Czechoslovak export rate. With one exception, all of the above exchange rates indicate that in all years the official dollar/ruble exchange rate was unrealistically high. The only exception to this occurred in 1974 when the derived Soviet export rate exceeded the official rate by about 32 percent; however, this was due to the fact that at official exchange rates the intra-CMEA relative prices of fuels exported by the Soviet Union were exceptionally low (64 percent below the level of wmp's).

Table 12. Official, Derived, and Implicit Commercial Dollar/Ruble Exchange Rates (Dollars per One Ruble)

Year	Official Soviet Rate	Derived Soviet Export Rate	Derived Soviet Import Rate	Derived Soviet Average Rate	Commercial Hungarian Rate	Implicit Hungarian Export Rate	Implicit Hungarian Import Rate	Implicit Czechoslovak Export Rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1960	1.1111	0.75	0.66	0.71	-	0.66	0.70	0.68
1961	1.1111	0.71	0.65	0.68	-	0.66	0.70	0.68
1962	1.1111	0.68	0.61	0.65	-	0.78	0.71	0.67
1963	1.1111	0.64	0.62	0.63	-	0.61	0.63	0.71
1964	1.1111	0.67	0.62	0.65	-	0.73	0.64	0.63
1965	1.1111	0.71	0.63	0.67	-	0.65	0.68	0.60
1966	1.1111	0.73	0.63	0.68	-	0.60	0.68	0.60
1967	1.1111	0.71	0.62	0.66	-	0.87	0.70	0.59
1968	1.1111	0.71	0.60	0.65	0.67	0.74	0.56	0.59 (0.58)
1969	1.1111	0.72	0.62	0.67	0.67	n.a.	n.a.	0.61 (0.55)
1970	1.1111	0.82	0.65	0.74	0.67	n.a.	n.a.	0.64 (0.55)
1971	1.1111	0.82	0.68	0.75	0.67	n.a.	n.a.	0.65 (0.59)
1972	1.2063	0.82	0.72	0.76	0.72	n.a.	n.a.	0.63 (0.59)
1973	1.3582	1.06	0.84	0.94	0.83	n.a.	n.a.	0.64 (0.61)
1974	1.3215	1.75	1.03	1.39	0.86	n.a.	n.a.	0.75 (0.71)
1975	1.3862	1.34	0.89	1.12	0.91	n.a.	n.a.	n.a.
1976	1.3264	1.25	0.82	1.04	0.84	n.a.	n.a.	n.a.
1977	1.3571	1.23	0.84	1.05	0.86	n.a.	n.a.	n.a.
1978	1.4634	1.19	0.85	1.02	0.88	n.a.	n.a.	n.a.

Sources: (1) - U.N. Monthly Bulletin of Statistics, Special Tables on Trade Conversion Factors;
 (2), (3), (4) - Table 1 above; rate (4) is an arithmetic average of (2) and (3);
 (5) - KAA [1978], p. 83 and Hungarian National Bank Loan Placement Memoranda in the United States;
 (6), (7) - materials obtained from the Hungarian Central Statistical Office;
 (8) - Jan Kláček, "Měření komparativní efektivnosti národního hospodářství" (The Measurement of the Comparative Efficiency of the National Economy), Politická ekonomie, No. 8/1973, and other Czechoslovak sources.

Figure 8. The Trend in the Official, Derived, and Implicit Commercial Dollar/Ruble Exchange Rates (Dollars per One Ruble)



Which of the eight dollar/ruble exchange rates presented in Table 12 should be viewed as the most realistic? The authors would argue that the derived Soviet import rate in column (3) should be viewed as the most realistic for policy purposes for the following reasons. First, this exchange rate reflects the realistic (world market) value of one ruble worth of an average bundle of Soviet imports from Eastern Europe. Second, since the pattern of intra-CMEA Six trade has been very similar to the pattern of the CMEA Six exports to the Soviet Union, this exchange rate also probably reflects the realistic (world market) value of one ruble worth of intra-CMEA Six trade rather closely.⁵⁸ Third, as Figure 8 indicates, the derived Soviet import rate also moved fairly closely with the Hungarian commercial rate during 1968-78. Since the Hungarian commercial rate is supposed to be set at a "realistic" level, it is certainly encouraging that the "realistic" dollar/ruble exchange rate we are suggesting is fairly close to what Hungarian decision-makers are actually using. Finally, the fact that the derived Soviet export exchange rate has always exceeded the derived Soviet import exchange rate should not encourage us to accept a "compromise" -- the derived average exchange rate in column (4) in Table 12. The difference between the derived Soviet export exchange rate and the import exchange rate during 1960-73 was only \$ 0.10 or less; the large difference between the two rates started in 1974 and was primarily due to the significant underpricing of Soviet fuel exports to Eastern Europe vis-à-vis the wmp's. The reason why the Soviet Union has been willing to underprice its exports relative to its imports is that by doing so it has generated certain non-market benefits (increased allegiance) in Eastern Europe, which have been used as inputs into the Soviet security production function. The availability of these non-market benefits

has allowed the Soviet Union to reduce its outlays on military manpower and hardware both at home and abroad below what they would have been otherwise. By taking into account the non-market benefits which the Soviet Union has received in return for underpricing its exports, we would find that the derived Soviet export exchange rate overstates the extent of genuine underpricing of Soviet exports, and hence it exceeds the "realistic" rate which should take into account all of the above considerations. Consequently, the derived Soviet export exchange rate is not a "realistic" rate because of special considerations governing Soviet exports and the derived import exchange rate, which is free of these special considerations, is closer to the "realistic" exchange rate.

IX. CMEA Trade Reform

Tables 13 - 15 below can be used to gain insight into the set of corrections in the official dollar/ruble exchange rate and in the structure of intra-CMEA ftp's which, ceteris paribus, would have produced a realistic dollar/ruble exchange rate and equality between relative intra-CMEA ftp's and relative wmp's during 1960-78. Such insight should give CMEA decision-makers some idea about the set of corrections which would have to be made today, in order to obtain a realistic dollar/ruble exchange rate and equality between relative intra-CMEA ftp's and relative wmp's. In fact, CMEA decisionmakers may wish to use the methodology developed in this paper and more recent data (which is available to them) to produce 1979 and 1980 entries for Tables 13 - 15. Truthfully, CMEA researchers could produce a series of studies along the lines of this study which should be far superior to ours because of their access to more complete, more disaggregate, and more reliable data. Without such studies, it is difficult to imagine that a serious reform of intra-CMEA ftp's could be undertaken.

Table 13 includes our estimates of derived dollar/ruble exchange rates for all intra-CMEA trade. Intra-CMEA trade consists of intra-CMEA Six trade, Soviet exports to the CMEA Six, and Soviet imports from the CMEA Six. Because the commodity structure of intra-CMEA Six trade is very similar to the commodity structure of Soviet imports from the CMEA Six we felt that it was reasonable to assume that the derived commodity dollar/ruble exchange rates for Soviet imports from the CMEA Six could also be used to convert intra-CMEA Six ruble trade into dollars (also measured at wmp's). The information on the derived dollar/ruble exchange rates for Soviet exports to and imports from the CMEA

Table 13. Estimates of Derived Dollar/Ruble Exchange Rates for Intra-CMEA Trade
(Dollars per One Ruble)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
1960	0.43	0.73	0.98	0.95	0.58	0.71
1961	0.43	0.70	0.93	0.99	0.52	0.69
1962	0.42	0.68	0.88	0.97	0.53	0.65
1963	0.43	0.64	0.88	0.96	0.53	0.64
1964	0.42	0.68	0.94	0.99	0.54	0.66
1965	0.43	0.71	0.94	1.05	0.54	0.67
1966	0.44	0.74	0.95	1.05	0.56	0.68
1967	0.45	0.76	0.90	1.03	0.53	0.66
1968	0.43	0.77	0.90	1.01	0.51	0.65
1969	0.43	0.76	0.95	1.00	0.53	0.66
1970	0.46	0.87	1.08	1.05	0.56	0.72
1971	0.49	1.10	1.00	1.10	0.56	0.74
1972	0.54	1.04	1.00	1.11	0.63	0.76
1973	0.63	1.46	1.30	1.23	0.76	0.92
1974	0.70	3.18	2.03	1.41	0.87	1.30
1975	0.67	1.92	1.47	1.21	0.75	1.07
1976	0.61	1.87	1.32	1.11	0.72	0.99
1977	0.64	1.75	1.34	1.20	0.74	1.00
1978	0.67	1.57	1.37	1.23	0.77	0.99

Table 14. The Ratio of the Ruble Value of Intra-CMEA Trade Converted into Dollars
at Official Exchange Rates to its Dollar Value at World Market Prices

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
1960	2.60	1.52	1.14	1.17	1.91	1.56
1961	2.61	1.59	1.20	1.12	2.13	1.62
1962	2.62	1.65	1.27	1.15	2.10	1.70
1963	2.61	1.73	1.27	1.16	2.09	1.73
1964	2.65	1.64	1.19	1.12	2.06	1.69
1965	2.59	1.56	1.18	1.05	2.06	1.65
1966	2.55	1.49	1.15	1.06	2.00	1.63
1967	2.50	1.47	1.23	1.03	2.09	1.68
1968	2.56	1.45	1.23	1.10	2.16	1.71
1969	2.56	1.46	1.17	1.11	2.08	1.68
1970	2.43	1.28	1.03	1.06	1.98	1.54
1971	2.26	1.01	1.11	1.01	1.98	1.50
1972	2.22	1.16	1.21	1.09	1.93	1.59
1973	2.16	0.93	1.04	1.10	1.79	1.47
1974	1.89	0.42	0.65	0.94	1.52	1.01
1975	2.03	0.72	0.94	1.15	1.86	1.29
1976	2.19	0.71	1.01	1.19	1.84	1.34
1977	2.13	0.78	1.01	1.13	1.84	1.36
1978	2.17	0.93	1.07	1.19	1.89	1.49

Table 15. The Degree of Relative Price Distortions in Intra-CMEA Trade vis-à-vis the World Market Prices

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
1960	1.66	0.97	0.73	0.75	1.22	1.00
1961	1.61	0.98	0.74	0.69	1.31	1.00
1962	1.54	0.97	0.75	0.68	1.24	1.00
1963	1.51	1.00	0.73	0.67	1.20	1.00
1964	1.57	0.97	0.70	0.66	1.22	1.00
1965	1.57	0.94	0.71	0.64	1.24	1.00
1966	1.56	0.91	0.71	0.65	1.22	1.00
1967	1.49	0.87	0.73	0.64	1.24	1.00
1968	1.50	0.85	0.72	0.64	1.26	1.00
1969	1.53	0.87	0.70	0.66	1.24	1.00
1970	1.58	0.83	0.67	0.69	1.29	1.00
1971	1.50	0.67	0.74	0.67	1.31	1.00
1972	1.39	0.72	0.76	0.68	1.21	1.00
1973	1.47	0.63	0.71	0.75	1.21	1.00
1974	1.87	0.41	0.64	0.93	1.50	1.00
1975	1.61	0.56	0.73	0.89	1.44	1.00
1976	1.63	0.53	0.75	0.89	1.37	1.00
1977	1.57	0.57	0.74	0.83	1.36	1.00
1978	1.46	0.63	0.72	0.80	1.27	1.00

Six for individual commodity categories was taken from Table 1 above.

Upon dividing the official dollar/ruble exchange rates taken from Table 12, column (1), by the estimates of derived dollar/ruble exchange rates for intra-CMEA trade presented in Table 13, we obtain in Table 14 the ratio of the ruble value of intra-CMEA trade converted into dollars at official exchange rates to its dollar value at wmp's. The last column in Table 14 is the most important. It provides information about the ratio of the overall average intra-CMEA price level to the overall average wmp level. This ratio indicates that at official exchange rates the average level of intra-CMEA ftp's exceeded the average level of wmp's anywhere between 1 percent (1974) and 73 percent (1963). Consequently, in order to equalize the two average price levels the official dollar/ruble exchange rates should have been reduced by about 49 percent (from 1.4634 to about 0.98 dollars per one ruble) in 1978, by 36 percent in 1977, and so on.

While the overvaluation of the ruble vis-à-vis the dollar can be easily corrected by changing the official exchange rates, the elimination of the distortions in the relative intra-CMEA ftp structure is a much more difficult problem. Measures of the relative price distortions in intra-CMEA trade for each commodity category for 1969-78 appear in Table 15. These measures were obtained as a result of dividing the ratio of the ruble value of intra-CMEA trade converted into dollars at official exchange rates to its dollar value at wmp's for each commodity category by the last column of Table 14, which is the ratio of overall average price levels. Table 15 indicates how prices in intra-CMEA trade for the goods in five main commodity categories should be adjusted once the value of the ruble is set at a realistic level relative to the dollar, i.e., once the overall average price level within CMEA is equal

to the average level of wmp's. For instance, in order to eliminate the relative price distortions in intra-CMEA ftp's vis-à-vis the wmp's in 1978, the average intra-CMEA ftp's of machinery should have been lowered by 46 percent, ftp's of fuels should have been increased by about 59 percent, ftp's of non-food raw materials should have been increased by about 39 percent, ftp's of food and non-food raw materials should have been increased by 25 percent, and finally the ftp's of industrial consumer goods should have been lowered by 27 percent.⁵⁹ Naturally, these are very rough calculations for large commodity categories and for all of CMEA, and are intended mostly to give the reader an idea about the direction of necessary adjustment. In the course of an actual intra-CMEA ftp reform it is likely that there would be considerable variance in ftp adjustments not just between but also within commodity categories.⁶⁰ Moreover, once differences in the quality of traded commodities (especially manufactures) are taken into account, it would be appropriate to use different adjustment factors for different countries depending on the level of their relative technological development and sophistication.⁶¹

A p p e n d i x I

Information about the Sample of Commodities
Used in this Study

Table A-1.
List of Commodities in the Sample
(According to the 1962 CTN Classification)

Exports

(1) Machinery and Equipment

no sample available

(2) Fuels

- 1 - Black coal (CTN 200)
- 2 - Coke (CTN 201)
- 3 - Crude oil (CTN 22)
- 4 - Oil products (CTN 23)
- 5 - Natural gas (CTN 23001)
- 6 - Electricity (CTN 23101)

(3) Non-Food Raw Materials

- 7 - Iron ore (CTN 24001)
- 8 - Manganese ore (CTN 24002)
- 9 - Chrome ore (CTN 24004)
- 10 - Graded asbestos (CTN 25001)
- 11 - Pig iron (CTN 26001)
- 12 - Billets for pipe (CTN 26402)
- 13 - Billets for rerolling (CTN 26403)
- 14 - Wide-gauge railroad rails (CTN 26405)
- 15 - Steel sections/profiles (CTN 26408)
- 16 - Wire rods (CTN 26410)
- 17 - Sheet steel (CTN 26411)
- 18 - High carbon structural steel (CTN 26421)
- 19 - Carbon structural sheet steel (CTN 26423)
- 20 - Unidentified rolled ferrous metals (CTN 264xx)
- 21 - Tinplate (CTN 26504)
- 22 - Gas pipes (CTN 26603)
- 23 - Rolled pipes (CTN 26606)
- 24 - Unidentified pipes (CTN 266xx)
- 25 - Blister/crude copper (CTN 2700101)
- 26 - Zinc (CTN 27004)
- 27 - Lead (CTN 27005)
- 28 - Aluminum (CTN 27008)
- 29 - Rolled aluminum (CTN 27205)
- 30 - Synthetic resins (CTN 30421)
- 31 - Apatite concentrate (CTN 34001 & 25013*)
- 32 - Superphosphate (CTN 34005)
- 33 - Potassium salts (CTN 34101)
- 34 - Ammonium sulfate (CTN 34201)
- 35 - Ammonium nitrate (CTN 34206)
- 36 - Synthetic rubber (CTN 35002)
- 37 - Cement (CTN 40001)
- 38 - Wood fiber sheets (CTN 4120205)

- 39 - Saw logs (CTN 50001)
- 40 - Pit props (CTN 50002)
- 41 - Pulp wood (CTN 50004)
- 42 - Unidentified round timber (CTN 500xx)
- 43 - Coniferous sawn lumber (CTN 50101)
- 44 - Plywood (CTN 50201)
- 45 - Sulfite cellulose (CTN 50502)
- 46 - Sulfate cellulose (CTN 50503)
- 47 - Newsprint (CTN 50601)
- 48 - Wrapping paper (CTN 50632)
- 49 - Unidentified paper (CTN 506xx)
- 50 - Cardboard (CTN 507)
- 51 - Cotton (CTN 51001)
- 52 - Wool (CTN 511)

(4) Food and Raw Materials for Food

- 53 - Wheat (CTN 70001)
- 54 - Rye (CTN 70002)
- 55 - Barley (CTN 70003)
- 56 - Corn (CTN 70005)
- 57 - Sunflower seeds (CTN 72005)
- 58 - Fresh-frozen meat (CTN 80001)
- 59 - Butter (CTN 80101)
- 60 - Canned fish (CTN 813)
- 61 - Refined sugar (CTN 84001)
- 62 - Sunflower oil (CTN 84109)

(5) Industrial Consumer Goods

- 63 - Household refrigerators (CTN 97005)
- 64 - Bicycles (CTN 97006)
- 65 - Clocks and watches (CTN 97012, 97011* & 97406*)
- 66 - Cameras (CTN 97013)
- 67 - Radio sets (CTN 97015)
- 68 - TV sets (CTN 97017)

Imports

(1) Machinery and Equipment

no sample available

(2) Fuels

- 1 - Hard coal (CTN 20001)
- 2 - Coke (CTN 201)
- 3 - Oil products (CTN 22)

(3) Non-Food Raw Materials

- 4 - Alumina (CTN 24216)
- 5 - Beams, girders, and pilings (CTN 26407)
- 6 - Steel sections/profiles (CTN 26408)
- 7 - Sheet steel (CTN 26411)
- 8 - High carbon structural steel (CTN 26421)
- 9 - Unidentified rolled ferrous metals (CTN 264xx)
- 10 - Petroleum assortment pipes (CTN 26601)
- 11 - Unidentified pipes (CTN 266xx)
- 12 - Zinc (CTN 27004)
- 13 - Caustic soda (CTN 30101)
- 14 - Soda ash (CTN 30102)
- 15 - Calcium carbide (CTN 30924)
- 16 - Synthetic dyes (CTN 30101)
- 17 - Varnish, enamel, nitrocellulose solvent (CTN 31106)
- 18 - Enamel paint, filler, butyric primer (CTN 31109)
- 19 - Synthetic rubber (CTN 35002)
- 20 - Wallfinishing materials (CTN 403)
- 21 - Linoleum (CTN 40507)
- 22 - Deciduous sawn lumber (CTN 50102)
- 23 - Plywood (CTN 50201)
- 24 - Paper (CTN 506)
- 25 - Synthetic staple fiber (CTN 51302)
- 26 - Tobacco (CTN 54 & 726*)
- 27 - Tarpaulin fabric (CTN 59216, 59217)

(4) Food and Raw Materials for Food

- 28 - Wheat (CTN 70001)
- 29 - Corn (CTN 70005)
- 30 - Fresh-frozen meat (CTN 80001)
- 31 - Fresh-frozen poultry (CTN 80002)
- 32 - Canned meat with beans and vegetables (CTN 80007)
- 33 - Unidentified meat and meat products (CTN 800xx)
- 34 - Eggs in the shell (CTN 80301)
- 35 - Fresh vegetables (CTN 83001)
- 36 - Canned vegetables (CTN 83002 & 83004*)
- 37 - Fresh grapes (CTN 83203)
- 38 - Fresh apples (CTN 83210)
- 39 - Canned fruits and berries (CTN 834 & 83412*)
- 40 - Refined sugar (CTN 84001)
- 41 - Non-concentrated fruit and berry juices (CTN 84308 & 83408*)
- 42 - Confiture (CTN 84309 & 83409*)
- 43 - Cognac (CTN 84403 & 85003*)
- 44 - Grape wine (CTN 84405 & 85009*)
- 45 - Non-vintage grape wines (CTN 85009*)
- 46 - Vintage grape wine (CTN 85010*)
- 47 - Cigarettes (CTN 8460302 & 8510302*)

(5) Industrial Consumer Goods

no sample available

* 1971 CTN classification number

Table A-2. Sample Size of Soviet Trade in Fuels with Eastern Europe (in Percent)

Year	Bulgaria	Czecho- slovakia	East Germany	Hungary	Poland	Romania	CMEA Six
<u>Exports of Fuels</u>							
1960	100	100	100	100	100	96	100
1961	100	100	100	100	100	96	100
1962	100	100	100	100	100	98	100
1963	100	100	100	100	100	99	100
1964	100	100	100	100	100	99	100
1965	100	100	100	100	100	100	100
1966	100	100	100	100	100	100	100
1967	100	100	100	100	100	100	100
1968	100	100	100	100	100	100	100
1969	100	100	100	100	100	100	100
1970	100	100	100	100	100	100	100
1971	100	100	100	100	100	100	100
1972	100	100	100	100	94	100	99
1973	100	100	100	100	100	100	100
1974	100	100	100	100	100	100	100
1975	100	100	100	100	100	100	100
1976	100	100	100	100	100	100	100
1977	100	100	100	100	100	100	100
1978	100	100	100	100	100	100	100
<u>Imports of Fuels</u>							
1960	-	-	0	0	100	100	93
1961	-	-	0	0	100	100	93
1962	-	-	0	0	100	100	92
1963	-	-	0	0	100	100	93
1964	-	-	0	0	100	100	93
1965	-	-	0	0	100	100	94
1966	-	-	0	0	100	100	94
1967	-	0	0	0	100	100	93
1968	-	0	0	0	100	100	92
1969	-	0	0	0	100	100	92
1970	-	0	0	0	100	100	91
1971	-	0	0	0	97	100	88
1972	-	0	0	0	96	100	86
1973	-	0	0	0	97	100	87
1974	-	0	0	0	99	100	91
1975	-	0	0	0	100	100	93
1976	-	0	0	0	100	100	96
1977	-	0	0	0	100	100	92
1978	-	0	0	0	100	100	83

Table A-3. Sample Size of Soviet Trade in Non-food Raw Materials with Eastern Europe (in Percent)

Year	Bulgaria	Czecho- slovakia	East Germany	Hungary	Poland	Romania	CMEA Six
<u>Exports of Non-Food Raw Materials</u>							
1960	74	70	82	76	87	83	79
1961	74	72	80	76	87	85	79
1962	75	74	80	83	88	84	81
1963	79	83	80	78	88	85	82
1964	79	84	88	80	90	86	86
1965	81	86	88	79	87	85	85
1966	82	84	88	76	89	86	85
1967	78	85	88	75	86	84	84
1968	79	86	85	78	88	83	84
1969	74	84	85	76	88	86	83
1970	81	83	80	74	88	78	81
1971	70	86	83	74	90	85	82
1972	68	81	82	77	90	80	81
1973	72	84	73	79	90	80	79
1974	56	80	72	78	87	76	75
1975	63	85	83	83	87	84	82
1976	58	86	74	85	89	77	79
1977	55	82	80	85	94	67	79
1978	51	82	76	85	94	68	77
<u>Imports of Non-Food Raw Materials</u>							
1960	44	24	9	26	66	49	28
1961	46	28	11	25	65	59	33
1962	43	33	10	14	57	61	32
1963	46	33	12	15	50	60	33
1964	55	33	9	13	47	61	34
1965	55	6	8	6	57	65	28
1966	55	7	7	10	59	68	29
1967	59	8	8	18	57	59	29
1968	63	9	12	24	53	67	33
1969	58	9	12	24	63	70	34
1970	58	10	12	29	64	70	35
1971	59	9	12	26	75	70	33
1972	54	8	10	30	51	65	29
1973	56	9	11	31	56	68	31
1974	61	9	9	30	62	73	31
1975	59	9	11	37	59	76	36
1976	60	8	12	40	50	66	33
1977	55	9	12	30	40	58	31
1978	54	9	12	38	36	69	31

Table A-4. Sample Size of Soviet Trade in Food and Raw Materials for Food with Eastern Europe (in Percent)

Year	Bulgaria	Czechoslovakia	East Germany	Hungary	Poland	Romania	CMEA Six
<u>Exports of Food</u>							
1960	96	83	88	96	72	80	85
1961	57	88	79	97	86	0	83
1962	85	75	90	95	88	0	85
1963	88	86	87	88	85	0	86
1964	91	81	85	71	38	95	81
1965	89	82	80	87	64	15	79
1966	85	83	83	69	73	55	81
1967	87	92	88	79	86	37	88
1968	90	90	86	80	79	4	85
1969	43	77	67	78	81	10	71
1970	63	77	74	62	83	9	75
1971	67	83	77	81	90	3	80
1972	0	72	77	41	76	6	71
1973	0	78	74	29	77	10	70
1974	0	68	75	4	88	2	66
1975	0	80	70	7	91	5	69
1976	0	67	62	9	73	4	60
1977	0	72	79	6	84	7	75
1978	0	27	15	8	48	15	28
<u>Imports of Food</u>							
1960	74	54	0	47	88	61	68
1961	81	49	0	56	61	63	68
1962	74	38	0	70	72	52	67
1963	73	56	0	75	27	71	69
1964	81	8	0	76	44	54	70
1965	85	0	14	67	66	67	74
1966	87	0	12	82	39	79	80
1967	84	0	9	83	42	71	78
1968	86	0	8	78	28	65	77
1969	88	0	8	81	21	60	78
1970	91	0	0	72	20	55	77
1971	91	0	0	85	20	63	79
1972	94	0	0	89	10	70	75
1973	94	0	0	91	15	72	78
1974	94	0	0	92	6	61	69
1975	86	0	0	86	8	64	73
1976	90	0	0	84	12	80	78
1977	90	0	0	93	20	75	82
1978	90	0	0	83	17	66	78

Table A-5. Sample Size of Soviet Exports of Industrial Consumer Goods to Eastern Europe (in Percent)

Year	Bulgaria	Czecho- slovakia	East Germany	Hungary	Poland	Romania	CMEA Six
<u>E x p o r t s o f I n d u s t r i a l C o n s u m e r G o o d s</u>							
1960	12	76	42	33	50	65	41
1961	9	57	39	35	60	55	40
1962	17	70	29	43	62	53	46
1963	20	61	11	42	52	73	43
1964	20	44	1	37	56	66	42
1965	17	35	8	49	41	66	37
1966	33	31	23	51	37	79	42
1967	46	39	23	40	65	75	50
1968	40	49	15	49	45	75	41
1969	47	66	32	51	47	76	50
1970	29	47	39	56	46	44	42
1971	30	49	38	37	36	45	38
1972	24	38	29	35	30	46	32
1973	24	38	27	36	37	53	34
1974	31	38	28	31	50	52	39
1975	32	32	35	35	56	55	43
1976	38	31	39	33	52	66	43
1977	34	25	33	31	56	50	41
1978	44	23	46	30	61	55	46

Appendix I I

An Alternative Method of Derivation of Dollar/Ruble Exchange Rates in the Absence of a Sample of Traded Commodities

The estimate of the dollar/ruble exchange rate for Soviet exports of machinery and equipment for 1960, $EX_{1,1960}$, was calculated as

$$EX_{1,1960} = \frac{(PX_{1,1960}^S / PW_{1,1960}^S)}{(PX_{1,1960}^R / PW_{1,1960}^S)} = \frac{0.50}{1.25} = 0.40. \dots (13)$$

The numerator in (13), equal to 0.5, is the ratio of Soviet dollar export prices earned in the Developed West to prevailing wmp's. So we have assumed that in 1960 Soviet machinery exports to CMEA would have fetched one-half of the price obtained for similar machinery by major Western exporters (more detailed discussion of the choice of the 50 percent "discount rate" follows below). The denominator of (13) is the ratio of intra-CMEA ruble ftp's to prevailing dollar wmp's at official exchange rates and was obtained from Marer [1972].⁶² Finally, in view of the fact that in 1960 the USSR probably did not charge uniform prices for its machinery exports to all CMEA countries, the above average export exchange rate $EX_{1,1960}$ of 0.4 was adjusted for individual countries (see discussion below). In particular, the following benchmark estimates of the dollar/ruble exchange rate for Soviet exports of machinery and equipment were utilized: 0.38 for Bulgaria, 0.38 for Czechoslovakia, 0.37 for East Germany, 0.41 for Hungary, 0.44 for Poland, and 0.38 for Romania.

The 1960 estimate of the dollar/ruble exchange rate for Soviet imports of machinery and equipment from CMEA country k, $EM_{1,1960,k}$, was obtained from:

$$EM_{1,1960,k} = \frac{(PX_{1,1960,k}^S / PW_{1,1960}^S)}{(PX_{1,1969,k}^R / PW_{1,1960}^S)} \dots (14)$$

where $PX_{1,1960,k}^{\$}$ and $PX_{1,1960,k}^R$ are the average unit price of exports of machinery and equipment from CMEA country k in year 1960 to the West (measured in dollars) and to other CMEA countries (measured in rubles), respectively. Similarly, the 1960 estimate of the dollar/ruble exchange rate for Soviet imports of industrial consumer goods from CMEA country k was obtained from:

$$EM_{5,1960,k} = \frac{(PS_{5,1960,k}^{\$}/PW_{5,1960}^{\$})}{(PX_{5,1960,k}^R/PW_{5,1960}^{\$})} . \quad \dots(15)$$

The numerators of (14) and (15) equal the following values, which we chose on the basis of statements in Marer [1972] and other considerations, and which represent, for each CMEA country, the ratio of actual export prices to the Developed West to prevailing wmp's:⁶³

Country	Machinery and Equipment	Industrial Consumer Goods
Bulgaria	0.45	0.55
Czechoslovakia	0.55	0.70
East Germany	0.60	0.75
Hungary	0.50	0.60
Poland	0.50	0.60
Romania	0.40	0.50
USSR	0.50	--

These estimates reflect the low quality of CMEA manufactured exports, which is the reason why the CMEA countries have to discount their manufactured exports so heavily. On the whole, CMEA manufactured exports embody relatively obsolete

designs, are more prone to breakdown, are poorly packaged, and generally suffer from more delivery and servicing problems than their Western counterparts.

However, we believe that the seriousness of the above problems is not uniform for all CMEA exporters and is likely to be inversely related to a country's general level of economic and technological development. Thus the discount rates presented above incorporate the hypothesis that East Germany and Czechoslovakia have historically offered lower-than-average discounts from wmp's to sell their exports in the Developed West, while Bulgaria and Romania have offered higher-than-average discounts. The above discount rates also reflect the assumption that Eastern Europe did not have to discount her exports of industrial consumer goods as much as her exports of machinery and equipment.

Next, the values of denominators of (14) and (15), the ratio of intra-CMEA ruble price level to the world market dollar price level, were obtained from Marer [1972]:⁶⁴

Country	Machinery and Equipment	Industrial Consumer Goods
Bulgaria	1.22	1.18
Czechoslovakia	1.20	0.98
East Germany	1.31	1.20
Hungary	1.29	1.23
Poland	1.22	1.23
Romania	1.22	1.20
USSR	1.25 (own est.)	-

Finally, the estimates of the dollar/ruble exchange rates for Soviet imports of machinery and equipment, and Soviet imports of industrial consumer

goods for each CMEA country were calculated according to (14) and (15), resulting in the following benchmark estimates for 1960:

Country	Machinery and Equipment	Industrial Consumer Goods
Bulgaria	0.37	0.47
Czechoslovakia	0.46	0.71
East Germany	0.46	0.63
Hungary	0.39	0.49
Poland	0.41	0.49
Romania	0.33	0.42
USSR	0.38	-

In the second stage, we collected data on intra-CMEA ruble ftp indices and East-West trade dollar price indices for 1960-78. The key sources of data on intra-CMEA ruble ftp's were Hewett [1974, 1979], Dietz [1979], materials for the study by Vaňous [1980b], and Hungarian statistical sources -- KAA [1978] and KSE [1979].⁶⁵ Soviet dollar export price index to the Developed West for machinery and equipment, and Soviet dollar import price indices from the Developed West for machinery and equipment, and for industrial consumer goods were reconstructed from the materials for the study by Vaňous [1980b], and from the Hungarian statistical sources cited above.⁶⁶

Finally, in the third stage, the benchmark estimates of the dollar/ruble exchange rates for Soviet exports of machinery and equipment were extended for the period 1960-78 using the relationship:

$$EX_{1,t} = EX_{1,1960} \cdot [(PX_{1,t}^S / PX_{1,1960}^S) / (PX_{1,t}^R / PX_{1,1960}^R)] \quad \dots (15)$$

where the ratio $(PX_{1,t}^S / PX_{1,1960}^S)$ is the rate of growth of Soviet dollar

export prices of machinery and equipment to the Developed West relative to 1960, and the ratio $(PX_{1,t}^R/PX_{1,1960}^R)$ is the rate of growth of Soviet ruble export prices for the same commodity to CMEA. Similar calculations were performed for Soviet imports of machinery and equipment, and for Soviet imports of industrial consumer goods with one minor modification.

The modification involved the replacement of the ratio $(PM_{j,t}^R/PM_{j,1960}^R)$ ($j=1,5$) by a geometric average of two alternative estimates of Soviet ruble import price indices from CMEA. The first estimate was the actual Soviet ruble import price index with a given CMEA country; the second estimate was the Soviet ruble import price index with all CMEA countries taken together. The reason for using an average of two alternative estimates is the following. The first estimate implies an assumption that all variation in the price index is due to changing prices. However, this is not particularly realistic because some changes in the price index are likely to have been caused by changes in the commodity composition of trade in broad commodity categories. The second estimate is much less likely to be affected by changes in the commodity composition, and thus also more likely to reflect genuine changes in prices. We took an average of these two estimates in order to reduce the variation in the Soviet ruble import price indices with individual CMEA countries, which is probably more attributable to differences in the commodity composition of Soviet imports than to genuine price differences (price discrimination). An adjustment along the same lines was also performed in the case of the Soviet ruble export price indices of machinery and equipment to individual CMEA countries.

A p p e n d i x I I I

Soviet Trade with Eastern Europe by Main Commodity Categories

Note: The sum of commodity trade flows may not add to total trade due to rounding.

Table A-6. Soviet Trade with the CMEA Six by Main Commodity Categories
(in Millions of Current Rubles)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	636.8	372.1	1205.4	475.5	77.0	2766.9
1961	783.9	437.8	1334.5	424.1	79.5	3059.7
1962	976.4	527.2	1437.6	544.0	88.7	3574.0
1963	1080.5	597.7	1482.3	503.7	82.7	3747.0
1964	1274.2	667.9	1717.3	321.9	67.9	4049.3
1965	1241.1	679.2	1758.2	340.2	78.6	4097.3
1966	1327.0	660.1	1775.7	380.3	78.7	4222.8
1967	1442.0	681.9	1835.5	484.6	90.7	4534.8
1968	1671.1	741.5	2048.1	493.3	118.4	5072.5
1969	1826.1	846.1	2227.9	559.2	119.1	5578.4
1970	1944.4	914.1	2599.5	486.8	137.8	6082.6
1971	2090.4	1050.7	2653.1	575.7	147.1	6517.2
1972	2300.8	1171.3	2742.7	351.1	160.7	6726.6
1973	2681.9	1298.3	2874.9	346.6	179.1	7380.8
1974	3184.9	1565.4	3196.5	496.0	262.5	8705.3
1975	3580.9	3126.1	4356.4	455.3	347.5	11866.2
1976	4216.4	3706.6	4619.9	176.5	387.3	13106.6
1977	4982.2	4675.9	4894.5	325.6	387.9	15266.1
1978	5637.9	5641.4	5127.3	112.3	426.8	16945.7
<u>I m p o r t s</u>						
1960	1153.4	187.3	534.5	170.7	469.5	2515.5
1961	1198.1	173.1	585.8	247.1	535.6	2739.7
1962	1550.7	164.3	626.8	229.1	660.2	3231.3
1963	1805.8	163.8	679.5	266.9	816.1	3732.1
1964	2001.4	157.6	756.6	289.3	800.5	4005.4
1965	2113.0	170.5	740.9	366.1	814.8	4205.3
1966	1925.7	157.5	662.0	349.1	921.5	4015.9
1967	2174.7	158.5	732.5	400.4	1117.2	4583.2
1968	2470.5	144.5	802.2	417.3	1244.7	5079.2
1969	2644.5	147.6	865.4	475.0	1277.7	5410.3
1970	2899.3	143.5	961.6	554.8	1411.2	5970.3
1971	3048.2	174.1	1000.7	638.5	1671.1	6532.6
1972	3720.3	204.5	1201.7	759.4	1801.0	7686.9
1973	4214.2	210.5	1151.8	728.1	1788.2	8092.8
1974	4450.2	195.5	1208.2	889.3	1856.9	8600.1
1975	5615.1	418.0	1630.4	1316.7	2330.4	11311.6
1976	6321.3	407.1	1797.6	1226.3	2473.8	12226.1
1977	7330.6	411.4	1930.8	1357.6	2771.4	13851.7
1978	9984.9	497.0	1977.6	1233.4	3083.2	16776.1

Source: Various [1980a].

Table A-7. Soviet Trade with Bulgaria by Main Commodity Categories
(in Millions of Current Rubles)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	138.1	26.5	94.0	10.9	26.6	296.1
1961	166.4	37.2	92.8	2.0	22.2	320.6
1962	213.3	46.3	108.3	10.3	24.8	403.0
1963	224.3	60.5	115.7	20.6	24.7	445.9
1964	252.5	83.3	144.9	14.4	15.5	510.7
1965	254.4	93.1	159.2	7.8	15.0	529.6
1966	309.8	110.4	181.1	9.9	16.2	627.4
1967	345.9	113.3	186.8	20.8	19.7	686.5
1968	412.0	134.4	244.3	30.8	32.9	854.4
1969	348.1	154.4	288.1	48.2	38.0	876.9
1970	345.8	166.5	274.8	23.3	33.7	844.0
1971	440.3	198.3	304.5	11.7	29.2	984.0
1972	543.4	210.1	322.7	7.9	37.2	1121.4
1973	603.4	245.0	332.1	13.0	37.2	1230.7
1974	704.7	291.7	408.1	19.1	55.0	1478.5
1975	777.4	657.0	519.8	40.9	64.3	2059.6
1976	887.6	747.6	577.0	0.4	64.1	2276.7
1977	993.1	935.2	673.6	0.4	56.5	2658.7
1978	1162.8	1136.2	783.9	0.7	60.8	3144.4
<u>I m p o r t s</u>						
1960	44.8	0.0	61.9	91.1	70.9	268.7
1961	49.9	0.0	59.0	105.9	78.6	293.5
1962	91.1	0.0	66.7	105.6	87.7	351.0
1963	104.8	0.0	76.0	127.9	91.5	400.3
1964	136.2	0.0	92.3	162.1	89.4	480.0
1965	165.7	0.0	75.6	201.6	111.1	553.9
1966	173.7	0.0	80.0	205.6	129.3	588.7
1967	198.1	0.0	99.6	243.4	155.2	696.4
1968	233.4	0.0	117.7	265.8	184.2	802.2
1969	264.6	0.0	123.0	300.6	189.0	877.2
1970	293.7	0.0	133.3	346.9	198.5	972.4
1971	351.2	0.0	146.3	391.2	195.9	1084.7
1972	471.0	0.0	171.0	386.1	195.7	1223.8
1973	596.3	0.0	156.7	369.5	201.4	1324.0
1974	684.5	0.0	147.3	398.5	195.2	1425.6
1975	825.6	0.0	274.7	588.6	242.4	1931.2
1976	1016.2	0.0	259.4	655.5	257.8	2188.8
1977	1216.6	0.0	328.8	671.4	277.7	2494.5
1978	1701.1	0.0	298.0	672.2	326.1	2997.4

Source: Various [1980a].

Table A-8. Soviet Trade with Czechoslovakia by Main Commodity Categories
(in Millions of Current Rubles)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	122.5	73.8	205.0	154.4	12.0	567.7
1961	141.7	96.3	226.5	112.4	10.4	587.3
1962	150.7	124.2	232.7	167.1	18.9	693.6
1963	178.2	139.9	261.6	169.8	14.5	764.1
1964	248.2	158.9	300.1	95.2	8.3	810.7
1965	230.7	159.1	326.1	108.5	8.9	833.3
1966	229.5	137.9	285.4	140.8	11.1	804.6
1967	215.7	159.9	318.2	163.2	13.6	870.7
1968	225.3	174.1	368.1	152.0	14.8	934.3
1969	232.5	208.6	397.4	144.4	15.7	998.7
1970	231.4	228.9	462.1	144.7	15.7	1082.7
1971	295.2	261.7	500.9	132.8	26.9	1217.6
1972	310.5	288.1	522.6	108.6	23.8	1253.7
1973	402.2	314.5	511.9	100.0	25.4	1354.0
1974	503.1	338.9	547.7	90.0	31.3	1511.1
1975	524.7	683.1	674.1	100.5	37.0	2019.4
1976	627.0	836.5	773.7	41.4	41.8	2320.5
1977	804.4	1022.0	725.3	82.8	45.8	2680.4
1978	910.7	1255.4	727.7	51.2	57.0	3002.0
<u>I m p o r t s</u>						
1960	290.1	0.0	118.7	23.5	154.9	587.2
1961	323.2	0.0	126.4	26.3	151.9	627.8
1962	432.1	0.0	125.0	21.6	163.6	742.3
1963	500.1	0.0	144.4	24.5	186.5	855.4
1964	522.9	0.0	169.6	5.9	173.6	872.0
1965	583.3	0.0	173.2	16.0	159.4	931.9
1966	506.2	0.0	149.3	9.0	163.0	827.5
1967	524.3	0.1	152.4	10.9	196.3	884.0
1968	515.1	0.2	158.8	12.0	205.0	891.0
1969	615.2	0.1	170.3	16.5	201.1	1003.2
1970	651.3	1.2	191.2	23.8	243.0	1110.5
1971	662.6	0.8	221.6	28.2	291.1	1204.2
1972	758.1	1.2	257.4	36.0	319.5	1372.1
1973	827.9	5.6	233.4	34.9	303.8	1405.6
1974	882.0	11.4	263.2	33.9	327.9	1518.4
1975	1104.1	15.7	296.7	27.2	448.0	1891.7
1976	1292.8	3.2	378.9	57.1	490.8	2222.7
1977	1472.8	3.5	368.7	51.9	539.9	2436.8
1978	2069.3	4.6	379.0	42.5	563.2	3058.6

Source: Vaňous [1980a].

Table A-9. Soviet Trade with East Germany by Main Commodity Categories
(in Millions of Current Rubles)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	122.4	140.5	472.6	204.3	6.7	946.4
1961	141.2	163.6	542.4	229.6	11.3	1088.2
1962	182.7	187.6	577.3	279.2	8.6	1235.3
1963	185.9	191.4	575.5	221.6	8.1	1182.5
1964	237.9	204.3	647.0	152.0	5.5	1246.7
1965	237.6	201.7	645.4	136.2	5.8	1226.7
1966	264.0	189.3	633.0	168.7	11.2	1266.1
1967	292.5	174.1	629.7	166.5	11.7	1274.6
1968	353.6	163.8	633.1	180.8	24.4	1355.8
1969	499.8	184.4	662.8	204.8	13.3	1565.1
1970	541.4	198.2	774.2	203.8	20.5	1738.1
1971	508.7	217.3	758.3	210.7	20.9	1715.8
1972	526.0	243.1	758.4	123.3	20.0	1670.8
1973	600.1	263.1	851.1	114.5	27.6	1856.4
1974	651.3	398.2	924.4	153.7	37.0	2164.6
1975	806.1	645.8	1311.6	158.7	58.0	2980.3
1976	882.1	808.8	1406.9	50.7	69.4	3217.9
1977	1037.6	1013.2	1434.8	114.6	60.9	3661.1
1978	1132.0	1242.6	1520.9	16.5	70.0	3982.0
<u>I m p o r t s</u>						
1960	524.1	10.5	196.9	1.3	103.4	836.2
1961	449.4	9.1	210.1	1.3	118.5	788.3
1962	555.1	10.3	224.6	1.4	174.9	966.3
1963	649.7	9.7	230.8	1.2	281.9	1173.3
1964	707.5	8.2	216.9	1.2	261.2	1194.9
1965	691.4	8.4	225.0	1.2	230.3	1156.2
1966	637.7	7.6	213.0	1.1	254.7	1114.2
1967	732.0	8.3	232.8	1.9	296.5	1271.4
1968	863.8	9.2	246.6	1.9	323.3	1444.8
1969	864.0	9.4	268.2	2.0	322.8	1466.4
1970	916.2	9.0	293.0	1.4	337.2	1556.9
1971	977.2	13.2	314.9	1.6	420.5	1727.5
1972	1203.9	18.7	378.3	3.1	430.6	2034.6
1973	1302.9	14.6	372.1	10.9	408.3	2108.9
1974	1309.1	4.0	401.6	51.8	384.1	2150.7
1975	1686.6	12.7	474.0	18.0	451.7	2643.0
1976	1762.5	9.0	504.9	21.2	481.7	2779.3
1977	2000.4	26.6	515.3	11.6	512.3	3066.3
1978	2596.7	18.0	530.6	10.5	555.4	3711.2

Source: Vaňous [1980a].

Table A-10. Soviet Trade with Hungary by Main Commodity Categories
(in Millions of Current Rubles)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	86.4	48.1	123.7	16.6	5.4	280.3
1961	96.3	50.9	141.7	30.5	4.0	323.4
1962	129.1	55.1	158.8	22.9	4.0	370.0
1963	143.6	72.8	165.4	13.1	4.0	399.1
1964	162.2	85.2	184.5	5.6	5.9	443.4
1965	158.8	92.3	199.3	32.4	8.4	491.3
1966	128.0	93.1	211.0	13.8	8.3	454.1
1967	164.2	88.1	232.4	32.1	10.2	526.9
1968	164.6	95.7	294.6	40.5	12.6	607.9
1969	150.4	112.1	309.2	40.7	17.5	630.0
1970	204.2	124.2	387.5	18.0	24.3	758.2
1971	271.7	145.7	396.2	41.8	25.4	880.8
1972	266.4	157.7	443.9	8.7	26.9	903.6
1973	289.4	177.7	462.7	16.8	28.9	975.6
1974	345.0	206.4	512.1	34.3	36.7	1134.4
1975	446.2	435.6	715.5	12.7	47.7	1657.7
1976	484.2	524.5	695.9	10.0	56.7	1771.3
1977	548.6	673.0	774.4	12.6	57.9	2066.5
1978	684.1	815.8	825.6	10.5	60.4	2396.4
<u>I m p o r t s</u>						
1960	130.4	3.0	24.3	12.6	53.1	223.4
1961	161.7	2.9	28.3	21.7	79.6	294.1
1962	186.0	2.3	32.2	28.6	100.7	349.9
1963	207.3	2.3	37.0	33.2	101.0	380.8
1964	222.0	2.4	56.9	44.5	107.5	433.3
1965	232.1	2.4	54.9	53.7	120.6	463.8
1966	222.7	2.3	45.2	53.9	136.6	460.7
1967	240.4	2.2	57.3	73.7	163.7	537.4
1968	280.8	1.8	64.6	77.9	176.9	602.1
1969	297.0	2.0	73.9	98.3	176.0	647.2
1970	339.2	2.2	78.7	111.6	189.9	721.6
1971	340.9	2.5	80.0	122.7	233.6	779.8
1972	440.6	2.4	103.7	155.0	276.4	978.1
1973	498.9	2.2	123.0	183.1	280.6	1087.8
1974	517.3	1.3	124.1	206.1	299.0	1147.8
1975	663.3	2.6	165.8	404.5	379.7	1615.9
1976	829.1	2.8	172.0	333.9	383.0	1720.8
1977	920.4	4.5	244.8	362.4	427.9	1960.1
1978	1402.0	62.2	195.2	330.4	440.1	2429.9

Source: Various [1980a].

Table A-11. Soviet Trade with Poland by Main Commodity Categories
(in Millions of Current Rubles)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	105.0	71.5	167.7	79.9	17.6	441.7
1961	151.2	81.7	172.7	48.4	23.6	477.6
1962	176.4	98.0	173.9	63.5	22.9	534.7
1963	209.1	116.0	176.8	76.2	18.2	596.3
1964	210.1	119.2	219.1	23.0	22.6	594.0
1965	225.8	117.8	226.3	53.2	30.8	653.9
1966	267.7	113.2	276.3	46.2	19.5	722.9
1967	277.1	130.5	289.0	100.6	23.8	821.0
1968	353.1	154.5	328.3	85.0	24.2	945.1
1969	388.0	166.2	381.7	116.1	26.9	1078.9
1970	438.3	175.0	480.2	91.1	30.3	1214.9
1971	418.1	199.6	483.0	159.6	32.0	1292.4
1972	447.1	238.8	487.0	95.4	38.6	1306.9
1973	559.3	258.2	483.9	97.7	45.7	1444.9
1974	721.7	293.6	568.2	168.7	85.9	1838.2
1975	728.3	638.0	823.4	133.3	124.2	2447.2
1976	1020.1	718.8	815.8	62.8	132.5	2750.0
1977	1160.5	946.4	841.2	109.9	137.9	3195.9
1978	1300.2	1126.3	845.4	29.7	148.0	3449.6
<u>I m p o r t s</u>						
1960	142.7	81.2	46.3	15.7	62.2	348.0
1961	174.0	81.5	51.7	45.5	76.4	429.2
1962	233.6	82.7	53.0	40.4	98.0	507.8
1963	286.5	84.2	62.6	10.8	108.9	553.0
1964	342.0	83.9	73.7	33.7	112.9	646.1
1965	367.9	107.5	70.1	43.6	113.5	702.6
1966	334.6	113.9	41.8	17.9	151.6	659.9
1967	409.5	121.0	52.0	20.1	209.5	812.2
1968	483.2	109.8	84.1	19.4	231.8	928.4
1969	517.0	114.2	107.5	17.2	256.0	1011.8
1970	606.1	111.8	119.6	23.4	274.0	1134.9
1971	621.6	139.4	86.5	39.2	340.7	1227.5
1972	715.9	167.8	129.0	99.7	383.3	1495.8
1973	834.8	171.0	100.4	63.8	385.2	1555.3
1974	912.1	163.7	110.8	126.6	432.2	1745.4
1975	1152.7	359.2	196.3	130.9	567.0	2406.1
1976	1242.8	360.4	228.1	53.8	599.7	2484.8
1977	1498.1	357.4	277.9	47.2	691.5	2872.1
1978	1982.1	385.2	344.1	63.1	825.5	3600.0

Source: Vaňous [1980a].

Table A-12. Soviet Trade with Romania by Main Commodity Categories
(in Millions of Current Rubles)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	62.5	11.7	142.4	9.4	8.7	234.6
1961	87.1	8.0	158.4	1.2	7.9	262.6
1962	124.2	16.1	186.6	0.9	9.5	337.3
1963	139.4	17.0	187.2	2.3	13.1	359.1
1964	163.3	16.9	221.7	31.7	10.2	443.8
1965	133.7	15.2	201.9	2.1	9.6	362.5
1966	128.1	16.2	190.0	1.0	12.4	347.7
1967	146.6	15.9	179.4	1.4	11.8	355.1
1968	162.5	19.1	179.7	4.2	9.4	375.0
1969	207.4	20.2	188.7	4.9	7.6	428.8
1970	183.2	21.4	220.7	5.9	13.3	444.6
1971	156.4	28.2	210.1	19.1	12.7	426.5
1972	207.4	33.6	208.0	7.1	14.2	470.2
1973	227.3	39.9	233.1	4.5	14.3	519.1
1974	259.1	36.6	236.1	30.1	16.6	578.5
1975	298.2	66.6	311.9	9.2	16.2	702.1
1976	315.4	70.2	350.5	11.2	22.9	770.2
1977	438.0	85.9	445.2	5.4	28.9	1003.5
1978	448.1	65.1	423.8	3.7	30.6	971.3
<u>I m p o r t s</u>						
1960	21.3	92.6	86.4	26.6	25.0	252.0
1961	39.9	79.6	110.2	46.4	30.6	306.7
1962	52.7	69.0	125.3	31.5	35.4	313.9
1963	57.3	67.5	128.6	69.4	46.3	369.2
1964	70.8	63.1	147.2	41.8	56.0	379.0
1965	72.6	52.2	142.1	50.0	79.9	396.9
1966	50.8	33.6	132.7	61.6	86.3	364.9
1967	70.4	26.8	138.3	50.4	95.9	381.9
1968	94.2	23.6	130.3	39.2	123.4	410.8
1969	86.7	22.0	122.6	40.5	132.7	404.5
1970	92.8	19.3	145.8	47.6	168.5	473.9
1971	94.7	18.1	151.4	55.6	189.3	509.0
1972	130.8	14.3	162.4	79.5	195.5	582.4
1973	153.3	17.2	166.1	65.8	208.8	611.2
1974	145.2	15.0	161.3	72.3	218.5	612.3
1975	183.8	27.9	222.9	147.5	241.6	823.7
1976	178.0	31.7	254.2	104.8	260.9	829.7
1977	222.2	19.3	245.2	213.0	322.0	1021.9
1978	233.7	27.0	230.7	114.7	372.9	979.0

Source: Vaňous [1980a].

A p p e n d i x I V

Estimates of Derived Dollar/Ruble Exchange Rates
for Soviet Trade with Individual CMEA Countries

Table A-13. Estimates of Derived Dollar/Ruble Exchange Rates for Soviet Trade with Bulgaria (Dollars per One Ruble)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	0.38	0.55	0.82	0.85	0.52*	0.56
1961	0.40	0.64	0.81	1.02	0.44*	0.55
1962	0.42	0.76	0.78	0.87	0.51*	0.57
1963	0.40	0.76	0.74	0.98	0.47*	0.57
1964	0.40	0.77	0.85	1.15	0.45*	0.61
1965	0.42	0.77	0.80	1.01	0.46*	0.61
1966	0.43	0.75	0.79	0.90	0.56*	0.60
1967	0.43	0.82	0.83	0.98	0.62*	0.63
1968	0.44	0.82	0.81	0.84	0.50*	0.62
1969	0.42	0.82	0.86	0.98	0.52*	0.67
1970	0.45	0.94	1.04	1.22	0.48*	0.76
1971	0.46	1.19	0.96	1.47	0.47*	0.77
1972	0.48	1.15	1.01	1.50*	0.45*	0.76
1973	0.57	1.62	1.34	1.58*	0.57*	1.00
1974	0.61	3.83	2.24	1.71*	0.54*	1.71
1975	0.63	1.96	1.56	1.66*	0.57*	1.31
1976	0.54	1.92	1.40	1.40*	0.44*	1.21
1977	0.56	1.81	1.44	1.44*	0.47*	1.22
1978	0.60	1.59	1.48	1.69*	0.44*	1.17
<u>I m p o r t s</u>						
1960	0.37	-	1.28+	1.02	0.47	0.83
1961	0.36	-	1.14+	1.03	0.44	0.78
1962	0.34	-	1.15+	1.01	0.45	0.72
1963	0.33	-	1.71+	0.96	0.45	0.82
1964	0.33	-	1.54+	0.99	0.46	0.81
1965	0.33	-	1.37+	1.01	0.45	0.74
1966	0.35	-	1.33+	1.05	0.47	0.75
1967	0.37	-	1.20+	1.09	0.45	0.76
1968	0.37	-	1.06+	1.09	0.44	0.73
1969	0.37	-	1.10+	1.06	0.48	0.73
1970	0.40	-	1.05+	1.08	0.51	0.75
1971	0.44	-	1.13+	1.12	0.50	0.79
1972	0.49	-	1.09+	1.15	0.56	0.79
1973	0.57	-	1.34+	1.25	0.68	0.87
1974	0.63	-	1.99+	1.29	0.78	0.98
1975	0.59	-	1.46+	1.02	0.72	0.86
1976	0.57	-	1.35+	1.06	0.69	0.82
1977	0.60	-	1.26+	1.12	0.71	0.84
1978	0.63	-	1.21+	1.20	0.75	0.83

Table A-14. Estimates of Derived Dollar/Ruble Exchange Rates for Soviet Trade with Czechoslovakia (Dollars per One Ruble)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	0.38	0.60	0.98	0.93	0.58*	0.78
1961	0.39	0.58	0.89	0.91	0.45*	0.71
1962	0.40	0.60	0.77	0.95	0.52*	0.70
1963	0.40	0.60	0.74	0.90	0.48*	0.67
1964	0.39	0.61	0.82	0.99	0.45*	0.66
1965	0.41	0.64	0.87	1.05	0.45*	0.72
1966	0.42	0.68	0.91	1.04	0.55*	0.75
1967	0.43	0.73	0.83	0.97	0.58*	0.73
1968	0.45	0.76	0.89	0.91	0.49*	0.76
1969	0.43	0.75	0.94	0.87	0.49*	0.76
1970	0.45	0.79	1.04	0.89	0.41*	0.83
1971	0.44	0.99	0.92	1.01	0.44*	0.82
1972	0.51	1.02	0.89	1.04	0.42*	0.83
1973	0.58	1.55	1.15	1.13	0.52*	1.06
1974	0.62	4.10	1.73	1.69	0.52*	1.86
1975	0.66	2.21	1.31	1.64	0.60*	1.45
1976	0.56	2.13	1.21	1.42	0.49*	1.36
1977	0.58	1.99	1.25	1.48	0.51*	1.33
1978	0.62	1.73	1.20	1.74	0.51*	1.24
<u>I m p o r t s</u>						
1960	0.46	-	1.05+	0.84*	0.71	0.66
1961	0.46	-	1.01+	0.87*	0.64	0.63
1962	0.48	-	1.00+	0.88*	0.61	0.61
1963	0.48	-	0.98+	1.47*	0.59	0.62
1964	0.47	-	1.02+	1.03*	0.60	0.61
1965	0.48	-	0.97+	1.07*	0.63	0.61
1966	0.48	-	1.00+	1.04*	0.65	0.61
1967	0.48	0.66*	0.92+	1.07*	0.61	0.59
1968	0.46	0.72*	0.92+	1.08*	0.60	0.58
1969	0.48	0.67*	0.97+	1.06*	0.62	0.60
1970	0.50	0.78*	1.06+	1.09*	0.66	0.64
1971	0.57	0.84*	1.01+	1.12*	0.67	0.69
1972	0.63	0.81*	1.00+	1.12*	0.76	0.74
1973	0.72	1.63*	1.28+	1.26*	0.93	0.88
1974	0.73	2.52*	1.99+	1.31*	1.09	1.09
1975	0.74	1.73*	1.47+	1.10*	0.90	0.91
1976	0.68	1.84*	1.31+	1.09*	0.87	0.84
1977	0.72	1.70*	1.38+	1.16*	0.89	0.87
1978	0.76	1.56*	1.40+	1.21*	0.94	0.88

Table A-15. Estimates of Derived Dollar/Ruble Exchange Rates for Soviet Trade with East Germany (Dollars per One Ruble)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	0.37	0.77	0.87	0.92	0.46*	0.80
1961	0.40	0.72	0.83	0.91	0.38*	0.77
1962	0.41	0.71	0.80	0.91	0.43*	0.75
1963	0.39	0.67	0.76	0.90	0.45*	0.71
1964	0.38	0.73	0.89	0.97	0.45*	0.77
1965	0.39	0.78	0.97	1.04	0.46*	0.83
1966	0.40	0.83	1.01	1.04	0.53*	0.86
1967	0.44	0.83	0.92	0.92	0.57*	0.79
1968	0.45	0.84	0.93	0.85	0.50*	0.78
1969	0.41	0.84	0.97	0.91	0.54*	0.76
1970	0.45	0.97	1.16	1.00	0.47*	0.89
1971	0.46	1.25	1.03	1.09	0.45*	0.89
1972	0.48	1.18	1.06	1.11	0.47*	0.89
1973	0.58	1.71	1.47	1.21	0.58*	1.19
1974	0.62	3.57	2.30	1.99	0.62*	1.98
1975	0.64	2.41	1.46	1.64	0.56*	1.44
1976	0.57	2.27	1.42	1.35	0.45*	1.38
1977	0.59	2.07	1.46	1.55	0.51*	1.37
1978	0.64	1.77	1.55	1.82	0.45*	1.34
<u>I m p o r t s</u>						
1960	0.46	0.70*	0.99+	0.97*	0.63	0.61
1961	0.46	0.68*	0.95+	1.07*	0.58	0.61
1962	0.44	0.64*	0.91+	1.01*	0.59	0.58
1963	0.45	0.57*	0.92+	1.03*	0.59	0.58
1964	0.45	0.59*	0.99+	1.01*	0.59	0.58
1965	0.45	0.62*	0.98+	1.00*	0.60	0.58
1966	0.46	0.64*	1.00+	0.97*	0.62	0.60
1967	0.48	0.66*	0.94+	1.02*	0.58	0.59
1968	0.45	0.72*	0.94+	1.04*	0.57	0.56
1969	0.45	0.67*	0.99+	1.04*	0.60	0.58
1970	0.47	0.78*	1.08+	1.09*	0.63	0.62
1971	0.52	0.84*	1.02+	1.12*	0.63	0.64
1972	0.59	0.81*	1.01+	1.12*	0.70	0.69
1973	0.66	1.63*	1.28+	1.26*	0.85	0.82
1974	0.75	2.52*	2.00+	1.31*	0.99	1.04
1975	0.69	1.73*	1.52+	1.10*	0.87	0.88
1976	0.66	1.84*	1.33+	1.09*	0.86	0.82
1977	0.70	1.70*	1.36+	1.16*	0.88	0.85
1978	0.73	1.56*	1.40+	1.21*	0.93	0.86

Table A-16. Estimates of Derived Dollar/Ruble Exchange Rates for Soviet Trade with Hungary (Dollars per one Ruble)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	0.41	0.61	0.90	0.95	0.50*	0.69
1961	0.42	0.59	0.91	0.95	0.43*	0.71
1962	0.42	0.55	0.83	0.88	0.50*	0.64
1963	0.42	0.59	0.80	0.97	0.45*	0.63
1964	0.41	0.62	0.84	0.98	0.45*	0.64
1965	0.43	0.58	0.88	1.03	0.51*	0.68
1966	0.42	0.61	0.87	1.00	0.65*	0.69
1967	0.43	0.67	0.86	1.02	0.63*	0.70
1968	0.43	0.68	0.89	1.00	0.55*	0.73
1969	0.41	0.65	0.94	0.95	0.51*	0.75
1970	0.45	0.74	1.09	0.97	0.47*	0.84
1971	0.45	0.89	1.00	1.12	0.48*	0.80
1972	0.46	0.89	0.97	1.24	0.48*	0.79
1973	0.55	1.29	1.29	1.13*	0.60*	1.05
1974	0.58	3.09	2.05	1.71*	0.57*	1.73
1975	0.57	1.69	1.42	1.66*	0.66*	1.24
1976	0.49	1.71	1.29	1.40*	0.53*	1.17
1977	0.50	1.51	1.33	1.44*	0.54*	1.15
1978	0.54	1.35	1.35	1.69*	0.53*	1.10
<u>I m p o r t s</u>						
1960	0.39	0.70*	1.00+	1.17	0.49	0.53
1961	0.39	0.68*	0.92+	1.09	0.45	0.51
1962	0.39	0.64*	0.91+	1.03	0.47	0.51
1963	0.40	0.57*	0.92+	1.03	0.47	0.53
1964	0.39	0.59*	0.98+	1.04	0.48	0.56
1965	0.40	0.62*	0.95+	1.11	0.50	0.57
1966	0.41	0.64*	0.97+	1.01	0.51	0.57
1967	0.42	0.66*	0.90+	1.04	0.50	0.58
1968	0.41	0.72*	0.91+	1.05	0.49	0.57
1969	0.42	0.67*	0.94+	1.08	0.50	0.60
1970	0.43	0.78*	1.04+	1.11	0.53	0.63
1971	0.46	0.84*	1.00+	1.14	0.52	0.64
1972	0.51	0.81*	1.01+	1.05	0.58	0.67
1973	0.59	1.63*	1.28+	1.28	0.70	0.81
1974	0.68	2.52*	1.81+	1.38	0.80	0.96
1975	0.65	1.73*	1.48+	1.19	0.69	0.88
1976	0.58	1.84*	1.34+	1.15	0.69	0.79
1977	0.61	1.70*	1.36+	1.20	0.70	0.83
1978	0.64	1.47*	1.39+	1.26	0.74	0.82

Table A-17. Estimates of Derived Dollar/Ruble Exchange Rates for Soviet Trade with Poland (Dollars per One Ruble)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	0.44	0.60	0.97	0.98	0.53*	0.77
1961	0.44	0.56	0.93	0.99	0.46*	0.69
1962	0.44	0.56	0.79	1.03	0.49*	0.65
1963	0.42	0.57	0.71	0.93	0.46*	0.60
1964	0.42	0.56	0.74	1.03	0.45*	0.59
1965	0.43	0.61	0.80	1.04	0.46*	0.64
1966	0.45	0.71	0.82	1.13	0.52*	0.68
1967	0.44	0.71	0.77	0.99	0.56*	0.67
1968	0.45	0.75	0.78	0.95	0.47*	0.66
1969	0.43	0.74	0.85	0.94	0.51*	0.68
1970	0.45	0.77	1.01	0.96	0.42*	0.75
1971	0.44	0.97	0.93	1.00	0.44*	0.77
1972	0.49	1.02	0.94	1.05	0.44*	0.79
1973	0.62	1.57	1.18	1.04	0.59*	1.00
1974	0.67	3.64	1.90	1.50	0.56*	1.60
1975	0.66	1.87	1.52	1.67	0.55*	1.31
1976	0.57	1.94	1.33	1.39	0.45*	1.17
1977	0.59	1.77	1.34	1.28	0.46*	1.15
1978	0.63	1.56	1.29	1.53	0.46*	1.10
<u>I m p o r t s</u>						
1960	0.41	0.85	1.13+	0.98*	0.49	0.65
1961	0.40	0.81	1.04+	1.28*	0.47	0.66
1962	0.39	0.78	0.99+	1.05*	0.48	0.59
1963	0.40	0.77	0.95+	1.17*	0.50	0.55
1964	0.40	0.85	1.05+	1.11*	0.54	0.59
1965	0.42	0.86	1.06+	1.24*	0.54	0.62
1966	0.43	0.83	1.05+	1.12*	0.53	0.58
1967	0.43	0.80	0.97+	1.07*	0.50	0.55
1968	0.42	0.76	0.95+	1.11*	0.50	0.54
1969	0.44	0.77	1.03+	1.06*	0.51	0.57
1970	0.46	0.94	1.16+	1.07*	0.55	0.62
1971	0.49	1.22	1.02+	1.11*	0.55	0.65
1972	0.35	1.04	0.96+	1.12*	0.61	0.69
1973	0.65	1.12	1.34+	1.28*	0.75	0.80
1974	0.74	1.83	2.27+	1.34*	0.87	1.02
1975	0.69	1.47	1.44+	1.14*	0.70	0.89
1976	0.62	1.27	1.22+	1.14*	0.68	0.80
1977	0.66	1.23	1.27+	1.22*	0.70	0.81
1978	0.69	1.27	1.34+	1.27*	0.74	0.84

Table A-18. Estimates of Derived Dollar/Ruble Exchange Rates for Soviet Trade with Romania (Dollars per One Ruble)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	0.38	0.73	0.84	0.84	0.56*	0.70
1961	0.40	0.73	0.77	0.84*	0.46*	0.64
1962	0.39	0.71	0.70	0.84*	0.55*	0.58
1963	0.39	0.68	0.65	0.84*	0.51*	0.55
1964	0.38	0.75	0.71	0.85	0.51*	0.60
1965	0.40	0.86	0.79	1.04*	0.49*	0.64
1966	0.40	0.88	0.82	1.28*	0.61*	0.66
1967	0.42	0.88	0.75	1.23*	0.67*	0.62
1968	0.43	0.88	0.75	0.90*	0.54*	0.61
1969	0.42	0.86	0.78	0.91*	0.59*	0.61
1970	0.45	1.44	1.02	0.97*	0.42*	0.79
1971	0.48	1.76	0.90	1.05*	0.41*	0.79
1972	0.51	1.43	0.91	1.07*	0.41*	0.76
1973	0.59	1.47	1.13	1.13*	0.52*	0.90
1974	0.65	1.87	1.70	1.71*	0.61*	1.21
1975	0.66	1.82	1.26	1.66*	0.61*	1.05
1976	0.53	1.66	1.18	1.40*	0.52*	0.94
1977	0.54	1.55	1.23	1.44*	0.53*	0.94
1978	0.58	1.65	1.23	1.69*	0.55*	0.94
<u>I m p o r t s</u>						
1960	0.33	0.74	1.09+	0.87	0.42	0.81
1961	0.33	0.72	1.07+	1.00	0.40	0.81
1962	0.33	0.65	1.03+	1.01	0.40	0.76
1963	0.34	0.52	0.95+	0.92	0.41	0.70
1964	0.35	0.53	0.98+	0.93	0.43	0.70
1965	0.35	0.55	0.94+	1.08	0.43	0.70
1966	0.34	0.56	1.00+	1.04	0.44	0.74
1967	0.35	0.57	0.94+	1.06	0.42	0.69
1968	0.35	0.66	0.97+	1.11	0.41	0.65
1969	0.34	0.59	1.02+	1.07	0.43	0.66
1970	0.36	0.70	1.10+	1.10	0.46	0.71
1971	0.40	0.65	1.09+	1.10	0.45	0.71
1972	0.44	0.62	1.05+	1.11	0.52	0.73
1973	0.52	1.70	1.39+	1.19	0.63	0.90
1974	0.58	1.74	2.14+	1.08	0.74	1.14
1975	0.58	1.46	1.68+	1.15	0.62	1.02
1976	0.47	1.68	1.28+	1.08	0.60	0.88
1977	0.50	1.57	1.25+	1.23	0.61	0.89
1978	0.52	1.51	1.24+	1.03	0.65	0.83

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Calculation of the Implicit Trade Subsidies Granted by the Soviet Union to Individual CMEA Countries

Note: The sum of component values may not equal the total value due to rounding.

Table A-19. Calculation of the Implicit Trade Subsidies Granted by the Soviet Union to Bulgaria
(in Millions of Current Dollars)

Year	Machinery Trade Balance	Fuel Trade Balance	Non-Food Raw Material Trade Balance	Food Trade Balance	Industrial Consumer Goods Trade Balance	Total Trade Balance	Total Ruble Balance Converted Into Dollars	Implicit Trade Subsidy
1960	36	15	-2	-84	-19	-55	23	-77
1961	49	24	8	-107	-25	-52	21	-73
1962	59	35	8	-98	-27	-23	38	-61
1963	55	46	-44	-103	-30	-75	37	-113
1964	56	64	-19	-144	-34	-77	25	-102
1965	52	72	24	-196	-43	-91	-18	-73
1966	72	83	37	-207	-52	-67	29	-96
1967	75	93	36	-245	-58	-99	-8	-91
1968	95	110	73	-265	-65	-51	38	-89
1969	48	127	112	-271	-71	-55	0	-55
1970	38	157	146	-345	-85	-91	-97	6
1971	43	236	127	-421	-84	-94	-79	-15
1972	39	242	140	-432	-93	-114	-81	-33
1973	4	397	235	-441	-116	79	-81	160
1974	-1	1117	621	-481	-123	1133	52	1081
1975	3	1288	410	-532	-138	1030	111	919
1976	-100	1435	458	-694	-150	949	72	877
1977	-174	1693	556	-751	-171	1153	138	1015
1978	-374	1807	800	-805	-218	1209	122	1087

Table A-20. Calculation of the Implicit Trade Subsidies Granted by the Soviet Union to Czechoslovakia
(in Millions of Current Dollars)

Year	Machinery Trade Balance	Fuel Trade Balance	Non-Food Raw Material Trade Balance	Food Trade Balance	Industrial Consumer Goods Trade Balance	Total Trade Balance	Total Ruble Balance Converted Into Dollars	Implicit Trade Subsidy
1960	-87	44	76	124	-103	54	-13	67
1961	-93	56	74	79	-93	23	-26	49
1962	-147	75	54	140	-90	31	-30	61
1963	-169	84	52	117	-103	-19	-56	37
1964	-149	97	73	88	-100	9	-37	46
1965	-185	102	116	97	-96	33	-60	92
1966	-147	94	110	137	-100	95	-14	109
1967	-159	117	124	147	-112	116	-8	124
1968	-136	132	182	125	-116	188	25	163
1969	-195	156	208	108	-117	161	-3	163
1970	-222	180	278	103	-154	185	-18	203
1971	-248	258	237	103	-183	167	9	158
1972	-319	293	208	73	-233	21	-88	109
1973	-363	478	290	69	-269	205	-45	250
1974	-385	1361	424	108	-341	1166	-8	1174
1975	-471	1482	447	135	-381	1213	116	1097
1976	-528	1776	440	-3	-407	1278	82	1195
1977	-594	2028	398	62	-457	1437	212	1225
1978	-1008	2165	343	38	-500	1037	-50	1086

Table A-21. Calculation of the Implicit Trade Subsidies Granted by the Soviet Union to East Germany
(in Millions of Current Dollars)

Year	Machinery Trade Balance	Fuel Trade Balance	Non-Food Raw Material Trade Balance	Food Trade Balance	Industrial Consumer Goods Trade Balance	Total Trade Balance	Total Ruble Balance Converted Into Dollars	Implicit Trade Subsidy
1960	-196	101	216	187	-62	246	67	179
1961	-150	112	251	208	-64	355	184	171
1962	-169	127	257	253	-99	368	156	212
1963	-220	123	225	198	-163	163	5	158
1964	-228	144	361	146	-152	272	30	242
1965	-218	152	406	140	-136	344	41	303
1966	-188	152	426	174	-152	413	91	322
1967	-223	139	360	151	-165	263	2	261
1968	-230	131	357	152	-172	238	-50	288
1969	-184	149	377	184	-186	340	58	282
1970	-187	185	582	202	-203	579	113	467
1971	-274	261	460	228	-256	419	-7	426
1972	-458	272	422	133	-292	77	-253	330
1973	-512	426	775	125	-331	483	-206	689
1974	-578	1411	1323	238	-357	2037	14	2023
1975	-648	1534	1194	240	-360	1961	296	1665
1976	-660	1819	1326	45	-383	2148	361	1786
1977	-788	2052	1394	164	-420	2402	506	1896
1978	-1171	2171	1615	17	-485	2147	233	1914

Table A-22. Calculation of the Implicit Trade Subsidies Granted by the Soviet Union to Hungary
(in Millions of Current Dollars)

Year	Machinery Trade Balance	Fuel Trade Balance	Non-Food Raw Material Trade Balance	Food Trade Balance	Industrial Consumer Goods Trade Balance	Total Trade Balance	Total Ruble Balance Converted Into Dollars	Implicit Trade Subsidy
1960	-15	27	87	1	-23	77	30	46
1961	-23	28	103	5	-34	80	15	65
1962	-18	29	103	-9	-45	58	10	48
1963	-23	42	98	-21	-46	50	10	41
1964	-20	51	99	-41	-49	41	6	35
1965	-25	52	123	-26	-56	68	16	53
1966	-38	55	140	-41	-64	53	-4	56
1967	-30	58	148	-44	-75	56	-6	62
1968	-44	64	203	-41	-80	102	3	98
1969	-63	72	221	-67	-79	83	-10	93
1970	-54	90	341	-106	-89	181	23	158
1971	-35	128	316	-93	-109	207	65	142
1972	-102	138	326	-152	-147	63	-50	113
1973	-135	226	439	-215	-179	135	-91	227
1974	-152	635	825	-226	-218	864	-13	877
1975	-177	732	771	-460	-231	635	37	598
1976	-244	892	667	-370	-234	711	40	671
1977	-287	1009	697	-417	-268	733	89	645
1978	-528	1010	843	-399	-294	633	-28	661

Table A-23. Calculation of the Implicit Trade Subsidies Granted by the Soviet Union to Poland
(in Millions of Current Dollars)

Year	Machinery Trade Balance	Fuel Trade Balance	Non-Food Raw Material Trade Balance	Food Trade Balance	Industrial Consumer Goods Trade Balance	Total Trade Balance	Total Ruble Balance Converted Into Dollars	Implicit Trade Subsidy
1960	-12	-26	110	63	-21	114	61	53
1961	-3	-20	107	-10	-25	48	32	16
1962	-13	-10	85	23	-36	49	16	33
1963	-27	1	66	58	-46	53	24	29
1964	-49	-5	85	-14	-51	-33	-31	-2
1965	-57	-21	107	1	-47	-17	-30	13
1966	-23	-14	183	32	-70	107	37	71
1967	-54	-4	172	78	-91	100	5	96
1968	-44	32	176	59	-105	119	9	110
1969	-61	35	214	91	-117	162	38	124
1970	-82	30	346	62	-138	219	49	169
1971	-121	24	361	116	-173	207	42	165
1972	-175	69	334	-11	-217	0	-131	131
1973	-196	214	436	20	-262	212	-88	300
1974	-191	769	828	83	-328	1161	94	1067
1975	-315	665	969	73	-329	1064	37	1027
1976	-189	937	807	26	-348	1232	211	1021
1977	-304	1236	774	83	-421	1368	262	1106
1978	-549	1268	629	-35	-543	771	-126	897

Table A-24. Calculation of the Implicit Trade Subsidies Granted by the Soviet Union to Romania
(in Millions of Current Dollars)

Year	Machinery Trade Balance	Fuel Trade Balance	Non-Food Raw Material Trade Balance	Food Trade Balance	Industrial Consumer Goods Trade Balance	Total Trade Balance	Total Ruble Balance Converted Into Dollars	Implicit Trade Subsidy
1960	17	-60	25	-15	-6	-39	-14	-25
1961	22	-51	4	-45	-9	-80	-36	-44
1962	31	-33	2	-31	-9	-41	18	-58
1963	35	-24	0	-62	-12	-63	-7	-56
1964	37	-21	13	-12	-19	-1	45	-47
1965	28	-16	26	-52	-30	-43	-24	-19
1966	34	-5	23	-63	-30	-41	-13	-28
1967	37	-1	5	-52	-32	-44	-18	-25
1968	37	1	8	-40	-46	-39	-23	-15
1969	58	4	22	-39	-53	-7	16	-23
1970	49	17	65	-47	-72	13	-21	33
1971	37	38	24	-41	-80	-22	-59	37
1972	48	39	19	-81	-96	-70	-82	12
1973	54	29	33	-73	-124	-81	-83	2
1974	84	42	56	-27	-152	5	-38	43
1975	90	80	19	-154	-140	-105	-124	19
1976	84	63	88	-98	-145	-7	-52	45
1977	125	103	241	-254	-181	34	-16	50
1978	138	67	235	-112	-226	103	-6	109

Table A-25. Soviet Trade with the CMEA Six by Main Commodity Categories Valued at World Market Prices (in Millions of Current Dollars)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	249.7	247.8	1082.8	442.8	40.8	2063.8
1961	320.1	279.1	1138.5	391.2	35.0	2163.8
1962	405.0	339.5	1125.3	508.1	44.6	2422.6
1963	436.0	378.8	1096.1	458.0	39.1	2407.9
1964	505.0	442.5	1419.6	314.4	31.2	2712.6
1965	513.0	469.3	1553.0	354.3	36.7	2926.4
1966	560.7	485.1	1608.1	398.1	44.2	3096.1
1967	624.3	519.8	1555.4	465.9	54.4	3219.9
1968	741.3	577.9	1767.3	442.9	59.3	3588.7
1969	766.7	651.2	2026.5	511.5	61.8	4017.7
1970	874.8	787.1	2796.9	471.6	62.0	4992.5
1971	947.7	1139.6	2568.7	607.5	66.4	5329.9
1972	1119.1	1254.3	2672.6	380.2	71.9	5498.0
1973	1565.3	2027.5	3716.1	397.8	102.2	7808.9
1974	1997.7	5703.2	6518.5	853.8	148.1	15221.2
1975	2283.8	6404.2	6269.5	751.9	201.0	15910.4
1976	2319.1	7461.0	6138.1	244.8	181.5	16344.4
1977	2830.4	8648.3	6676.2	467.3	191.0	18813.2
1978	3435.2	9143.6	7117.2	189.7	204.2	20090.0
<u>I m p o r t s</u>						
1960	507.5	147.0	569.6	167.2	275.4	1666.7
1961	519.2	131.5	592.2	261.6	284.5	1789.1
1962	663.7	117.4	616.9	230.8	351.0	1979.8
1963	784.0	106.8	699.5	270.7	438.4	2299.4
1964	857.2	111.0	807.3	290.3	436.0	2501.9
1965	918.6	127.9	752.1	389.6	444.5	2632.7
1966	849.6	119.7	689.1	364.9	512.6	2535.9
1967	978.0	119.1	710.6	430.5	588.4	2826.6
1968	1063.1	107.1	767.7	452.6	641.5	3032.0
1969	1163.7	108.6	871.3	505.9	684.7	3334.2
1970	1331.8	128.3	1040.0	603.4	802.9	3906.4
1971	1539.6	195.7	1043.6	716.1	951.9	4446.9
1972	2094.7	201.4	1225.0	850.5	1149.6	5521.2
1973	2712.6	257.3	1507.9	913.9	1383.4	6775.0
1974	3220.8	357.8	2441.4	1158.5	1666.8	8855.2
1975	3801.0	622.4	2460.2	1450.3	1779.4	10113.3
1976	3956.7	538.6	2352.2	1338.7	1847.7	10033.8
1977	4851.9	528.7	2616.3	1580.1	2108.5	11685.5
1978	6926.4	656.7	2652.5	1485.4	2469.4	14190.3

Table A-26. Soviet Trade with Bulgaria by Main Commodity Categories Valued at World Market Prices (in Millions of Current Dollars)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	52.5	14.6	77.1	9.3	13.8	167.2
1961	66.6	23.8	75.2	2.0	9.8	177.3
1962	89.6	35.2	84.5	9.0	12.6	230.9
1963	89.7	46.0	85.6	20.2	11.6	253.1
1964	101.0	64.1	123.2	16.6	7.0	311.8
1965	106.8	71.7	127.4	7.9	6.9	320.7
1966	133.2	82.8	143.1	8.9	9.1	377.1
1967	148.7	92.9	155.0	20.4	12.2	429.3
1968	181.3	110.2	197.9	25.9	16.5	531.7
1969	146.2	126.6	247.8	47.2	19.8	587.6
1970	155.6	156.5	285.8	28.4	16.2	642.5
1971	202.5	236.0	292.3	17.2	13.7	761.8
1972	260.8	241.6	325.9	11.9	16.7	857.0
1973	343.9	396.9	445.0	20.5	21.2	1227.6
1974	429.9	1117.2	914.1	32.7	29.7	2523.6
1975	489.8	1287.7	810.9	67.9	36.7	2692.9
1976	479.3	1435.4	807.8	0.6	28.2	2751.3
1977	556.1	1692.7	970.0	0.6	26.6	3246.0
1978	697.7	1806.6	1160.2	1.2	26.8	3692.3
<u>I m p o r t s</u>						
1960	16.6	0.0	79.2	92.9	33.3	222.1
1961	18.0	0.0	67.3	109.1	34.6	228.9
1962	31.0	0.0	76.7	106.7	39.5	253.8
1963	34.6	0.0	130.0	122.8	41.2	328.5
1964	44.9	0.0	142.1	160.5	41.1	388.7
1965	54.7	0.0	103.6	203.6	50.0	411.9
1966	60.8	0.0	106.4	215.9	60.8	443.8
1967	73.3	0.0	119.5	265.3	69.8	528.0
1968	86.4	0.0	124.8	290.8	81.0	583.0
1969	97.9	0.0	135.3	318.6	90.7	642.6
1970	117.5	0.0	140.0	374.7	101.2	733.3
1971	154.5	0.0	165.3	438.1	98.0	855.9
1972	230.8	0.0	186.4	444.0	109.6	970.8
1973	339.9	0.0	210.0	461.9	137.0	1148.7
1974	431.2	0.0	293.1	514.1	152.3	1390.7
1975	487.1	0.0	401.1	600.4	174.5	1663.1
1976	579.2	0.0	350.2	694.8	177.9	1802.1
1977	730.0	0.0	414.3	752.0	197.2	2093.4
1978	1071.7	0.0	360.6	826.6	244.6	2483.5

Table A-27. Soviet Trade with Czechoslovakia by Main Commodity Categories Valued at World Market Prices (in Millions of Current Dollars)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	46.6	44.3	200.9	143.6	7.0	442.3
1961	55.3	55.9	201.6	102.3	4.7	419.7
1962	60.3	74.5	179.2	158.7	9.8	482.6
1963	71.3	83.9	193.6	152.8	7.0	508.6
1964	96.8	96.9	246.1	94.2	3.7	537.8
1965	94.6	101.8	283.7	113.9	4.0	598.0
1966	96.4	93.8	259.7	146.4	6.1	602.4
1967	92.8	116.7	264.1	158.3	7.9	639.8
1968	101.4	132.3	327.6	138.3	7.3	706.9
1969	100.0	156.5	373.6	125.6	7.7	753.3
1970	104.1	180.8	480.6	128.8	6.4	900.8
1971	129.9	259.1	460.8	134.1	11.8	995.8
1972	158.4	293.9	465.1	112.9	10.0	1040.3
1973	233.3	487.5	588.7	113.0	13.2	1435.6
1974	311.9	1389.5	947.5	152.1	16.3	2817.3
1975	346.3	1509.7	883.1	164.8	22.2	2926.0
1976	351.1	1781.7	936.2	58.8	20.5	3148.3
1977	466.6	2033.8	906.6	122.5	23.4	3552.9
1978	564.6	2171.8	873.2	89.1	29.1	3727.9
<u>I m p o r t s</u>						
1960	133.4	0.0	124.6	19.7	110.0	387.8
1961	148.7	0.0	127.7	22.9	97.2	396.4
1962	207.4	0.0	125.0	19.0	99.8	451.2
1963	240.0	0.0	141.5	36.0	110.0	527.6
1964	245.8	0.0	173.0	6.1	104.2	529.0
1965	280.0	0.0	168.0	17.1	100.4	565.5
1966	243.0	0.0	149.3	9.4	106.0	507.6
1967	251.7	0.1	140.2	11.7	119.7	523.3
1968	236.9	0.1	146.1	13.0	123.0	519.1
1969	295.3	0.1	165.2	17.5	124.7	602.7
1970	325.7	0.9	202.7	25.9	160.4	715.6
1971	377.7	0.7	223.6	31.6	195.0	828.8
1972	477.6	1.0	257.4	40.3	242.8	1019.1
1973	596.1	9.1	298.8	44.0	282.5	1230.5
1974	696.8	28.7	523.8	44.4	357.4	1651.1
1975	817.0	27.2	436.1	29.9	403.2	1713.5
1976	879.1	5.9	496.4	62.2	427.0	1870.6
1977	1060.4	6.0	508.8	60.2	480.5	2115.9
1978	1572.7	7.2	530.6	51.4	529.4	2691.3

Table A-28. Soviet Trade with East Germany by Main Commodity Categories Valued at World Market Prices (in Millions of Current Dollars)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	45.3	108.2	411.2	188.0	3.1	755.7
1961	56.5	117.8	450.2	208.9	4.3	837.7
1962	74.9	133.2	461.8	254.1	3.7	927.7
1963	72.5	128.2	437.4	199.4	3.6	841.2
1964	90.4	149.1	575.8	147.4	2.5	965.3
1965	92.7	157.3	626.0	141.6	2.7	1020.3
1966	105.6	157.1	639.3	175.4	5.9	1083.4
1967	128.7	144.5	579.3	153.2	6.7	1012.4
1968	159.1	137.6	588.8	153.7	12.2	1051.4
1969	204.9	154.9	642.9	186.4	7.2	1196.3
1970	243.6	192.3	898.1	203.8	9.6	1547.4
1971	234.0	271.6	781.0	229.7	9.4	1525.7
1972	252.5	286.9	803.9	136.9	9.4	1489.5
1973	348.1	449.9	1251.1	138.5	16.0	2203.6
1974	403.8	1421.6	2126.1	305.9	22.9	4280.3
1975	515.9	1556.4	1914.9	260.3	32.5	4280.0
1976	502.8	1836.0	1997.8	68.4	31.2	4436.2
1977	612.2	2097.3	2094.8	177.6	31.1	5013.0
1978	724.5	2199.4	2357.4	30.0	31.5	5342.8
<u>I m p o r t s</u>						
1960	241.1	7.4	194.9	1.3	65.1	509.8
1961	206.7	6.2	199.6	1.4	68.7	482.6
1962	244.2	6.6	204.4	1.4	103.2	559.8
1963	292.4	5.5	212.3	1.2	166.3	677.8
1964	318.4	4.8	214.7	1.2	154.1	693.3
1965	311.1	5.2	220.5	1.2	138.2	676.2
1966	293.3	4.9	213.0	1.1	157.9	670.2
1967	351.4	5.5	218.8	1.9	172.0	749.6
1968	388.7	6.6	231.8	2.0	184.3	813.4
1969	388.8	6.3	265.5	2.1	193.7	856.4
1970	430.6	7.0	316.4	1.5	212.4	968.0
1971	503.1	11.1	321.2	1.8	264.9	1107.1
1972	710.3	15.1	382.1	3.5	301.4	1412.4
1973	859.9	23.8	476.3	13.7	347.1	1720.8
1974	981.8	10.1	803.2	67.9	380.3	2243.2
1975	1163.8	22.0	720.5	19.8	393.0	2319.0
1976	1163.3	16.6	671.5	23.1	414.3	2288.7
1977	1400.3	45.2	700.8	13.5	450.8	2610.6
1978	1895.6	28.1	742.8	12.7	516.5	3195.7

Table A-29. Soviet Trade with Hungary by Main Commodity Categories Valued at World Market Prices (in Millions of Current Dollars)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	35.4	29.3	111.3	15.8	2.7	194.6
1961	40.4	30.0	128.9	29.0	1.7	230.1
1962	54.2	30.3	131.8	20.2	2.0	238.5
1963	60.3	43.0	132.3	12.7	1.8	250.1
1964	66.5	52.8	155.0	5.5	2.7	282.4
1965	68.3	53.5	175.4	33.4	4.3	334.9
1966	53.8	56.8	183.6	13.8	5.4	313.3
1967	70.6	59.0	199.9	32.7	6.4	368.7
1968	70.8	65.1	262.2	40.5	6.9	445.5
1969	61.7	72.9	290.6	38.7	8.9	472.8
1970	91.9	91.9	422.4	17.5	11.4	635.1
1971	122.3	129.7	396.2	46.8	12.2	707.1
1972	122.5	140.4	430.6	10.8	12.9	717.2
1973	159.2	229.2	596.9	19.0	17.3	1021.6
1974	200.1	637.8	1049.8	58.7	20.9	1967.3
1975	254.3	736.2	1016.0	21.1	31.5	2059.1
1976	237.3	896.9	897.7	14.0	30.1	2075.9
1977	274.3	1016.2	1030.0	18.1	31.3	2369.9
1978	369.4	1101.3	1114.6	17.7	32.0	2635.1
<u>I m p o r t s</u>						
1960	50.9	2.1	24.3	14.7	25.0	118.0
1961	63.1	2.0	26.0	23.7	35.8	150.5
1962	72.5	1.5	29.3	29.5	47.3	180.1
1963	82.9	1.3	34.0	34.2	47.5	199.9
1964	86.6	1.4	55.8	46.3	51.6	241.6
1965	92.8	1.5	52.2	59.6	60.3	266.4
1966	91.3	1.5	43.8	54.4	69.7	260.7
1967	101.0	1.5	51.6	76.6	81.9	312.5
1968	115.1	1.3	58.8	81.8	86.7	343.7
1969	124.7	1.3	69.5	106.2	88.0	389.7
1970	145.9	1.7	81.8	123.9	100.6	453.9
1971	156.8	2.1	80.0	139.9	121.5	500.3
1972	224.7	1.9	104.7	162.8	160.3	654.4
1973	294.4	3.6	157.4	234.4	196.4	886.2
1974	351.8	3.3	224.6	284.4	239.2	1103.3
1975	431.1	4.5	245.4	481.4	262.0	1424.4
1976	480.9	5.2	230.5	384.0	264.3	1354.8
1977	561.4	7.7	332.9	434.9	299.5	1636.4
1978	897.3	91.4	271.3	416.3	325.7	2002.0

Table A-30. Soviet Trade with Poland by Main Commodity Categories Valued at World Market Prices (in Millions of Current Dollars)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	46.2	42.9	162.7	78.3	9.3	339.4
1961	66.5	45.8	160.6	47.9	10.9	331.7
1962	77.6	54.9	137.4	65.4	11.2	346.5
1963	87.8	66.1	125.5	70.9	8.4	358.7
1964	88.2	66.8	162.1	23.7	10.2	351.0
1965	97.1	71.9	181.0	55.3	14.2	419.5
1966	120.5	80.4	226.6	52.2	10.1	489.7
1967	121.9	92.7	222.5	99.6	13.3	550.0
1968	158.9	115.9	256.1	80.8	11.4	623.0
1969	166.8	123.0	324.4	109.1	13.7	737.1
1970	197.1	134.8	485.0	87.5	12.7	917.1
1971	184.0	193.6	449.2	159.6	14.1	1000.5
1972	219.1	243.6	457.8	100.2	17.0	1037.6
1973	346.8	405.4	571.0	101.6	27.0	1451.7
1974	483.5	1068.7	1079.6	253.1	48.1	2933.0
1975	480.7	1193.1	1251.6	222.6	68.3	3216.2
1976	581.5	1394.5	1085.0	87.3	59.6	3207.9
1977	684.7	1675.1	1127.2	140.7	63.4	3591.1
1978	819.1	1757.0	1090.6	45.4	68.1	3780.2
<u>I m p o r t s</u>						
1960	58.5	69.0	52.3	15.4	30.5	225.7
1961	69.6	66.0	53.8	58.2	35.9	283.5
1962	91.1	64.5	52.5	42.4	47.0	297.5
1963	114.5	64.8	59.5	12.6	54.5	306.0
1964	136.8	71.3	77.4	37.4	61.0	383.9
1965	154.5	92.5	74.3	54.1	61.3	436.6
1966	143.9	94.5	43.9	20.0	80.3	382.7
1967	176.1	96.8	50.4	21.5	104.8	449.6
1968	202.9	83.4	79.9	21.5	115.9	503.7
1969	227.5	87.9	110.7	18.2	130.6	574.9
1970	278.8	105.1	138.7	25.0	150.7	698.4
1971	304.6	170.1	88.2	43.5	187.4	793.8
1972	393.7	174.5	123.8	111.7	233.8	1037.6
1973	542.6	191.5	134.5	81.7	288.9	1239.2
1974	675.0	299.5	251.5	169.6	376.0	1771.7
1975	795.4	523.0	282.7	149.2	396.9	2152.2
1976	770.5	457.7	278.3	61.3	407.8	1975.7
1977	983.7	439.6	352.9	57.6	484.1	2322.9
1978	1367.7	489.2	461.1	80.1	610.9	3009.0

Table A-31. Soviet Trade with Romania by Main Commodity Categories Valued at World Market Prices (in Millions of Current Dollars)

Year	Machinery and Equipment	Fuels	Non-Food Raw Materials	Food and Raw Materials for Food	Industrial Consumer Goods	All Goods
<u>E x p o r t s</u>						
1960	23.8	8.5	119.6	7.9	4.9	164.7
1961	34.8	5.8	122.0	1.0	3.6	167.3
1962	48.4	11.4	130.6	0.8	5.2	196.5
1963	54.4	11.6	121.7	1.9	6.7	196.2
1964	62.1	12.7	157.4	26.9	5.2	264.3
1965	53.5	13.1	159.5	2.2	4.7	232.9
1966	51.2	14.3	155.8	1.3	7.6	230.1
1967	61.6	14.0	134.6	1.7	7.9	219.7
1968	69.9	16.8	134.8	3.8	5.1	230.3
1969	87.1	17.4	147.2	4.5	4.5	260.6
1970	82.4	30.8	225.1	5.7	5.6	349.7
1971	75.1	49.6	189.1	20.1	5.2	339.1
1972	105.8	48.0	189.3	7.6	5.8	356.5
1973	134.1	58.7	263.4	5.1	7.4	468.7
1974	168.4	68.4	401.4	51.5	10.1	699.8
1975	196.8	121.2	393.0	15.3	9.9	736.2
1976	167.2	116.5	413.6	15.7	11.9	724.9
1977	236.5	133.1	547.6	7.8	15.3	940.4
1978	259.9	107.4	521.3	6.3	16.8	911.7
<u>I m p o r t s</u>						
1960	7.0	68.5	94.2	23.1	10.5	203.4
1961	13.2	57.3	117.9	46.4	12.2	247.0
1962	17.4	44.9	129.1	31.8	14.2	237.3
1963	19.5	35.1	122.2	63.8	19.0	259.6
1964	24.8	33.4	144.3	38.9	24.1	265.4
1965	25.4	28.7	133.6	54.0	34.4	276.1
1966	17.3	18.8	132.7	64.1	38.0	270.8
1967	24.6	15.3	130.0	53.4	40.3	263.6
1968	33.0	15.6	126.4	43.5	50.6	269.0
1969	29.5	13.0	125.1	43.3	57.1	267.9
1970	33.4	13.5	160.4	52.4	77.5	337.2
1971	37.9	11.8	165.0	61.2	85.2	361.0
1972	57.6	8.9	170.5	88.2	101.7	426.8
1973	79.7	29.2	230.9	78.3	131.5	549.7
1974	84.2	26.1	345.2	78.1	161.7	695.3
1975	106.6	40.7	374.5	169.6	149.8	841.2
1976	83.7	53.3	325.4	113.2	156.5	732.0
1977	111.1	30.3	306.5	262.0	196.4	906.3
1978	121.5	40.8	285.1	118.1	242.4	808.9

F o o t n o t e s

¹In the above comparison of Soviet export and import price indices with wmp's, account was taken of the fact that most intra-CMEA commercial transactions are settled in non-convertible rubles rather than in convertible dollars or other hard currencies. At the official exchange rate the (transferable) ruble is greatly overvalued vis-à-vis the dollar; the degree of overvaluation of the ruble vis-à-vis the dollar is discussed in detail in Sections V, VIII, and IX.

²The term two-way terms of trade implies that a given amount of good A can be exchanged for a particular amount of good B on the world market, which in turn can be exchanged again for the original amount of good A and vice versa. The term one-way terms of trade implies that a given amount of good A can be exchanged for a particular amount of good B but this amount of good B can be exchanged again only for a lower-than-original amount of good A or vice versa.

³During 1960-80, the Soviet Union has maintained military bases in East Germany (20 divisions), Hungary (4 divisions), and Poland (2 divisions). Since 1968, 5 Soviet divisions have been stationed in Czechoslovakia.

⁴In writing this Section, we relied extensively on the review of literature concerning the implementation of intra-CMEA price rules in Hewett [1974], pp. 43-48.

⁵Menderhausen [1960], pp. 153 and 155.

⁶Menderhausen [1959], p. 117.

⁷Ibid., p. 118.

⁸Ibid.

⁹E.g., we calculate (see Table 13 in Section IX) that in 1960 the average level of intra-CMEA foreign trade prices (ftp's) exceeded the average level of wmp's by 56 percent at the official exchange rate. Hence, the realistic exchange rate for the ruble vis-à-vis the dollar was about $\$ 0.71 = R 1$ instead of the official rate of $\$ 1.1111 = R 1$.

¹⁰Menderhausen [1960], Table 2, p. 154.

¹¹Holzman [1965], pp. 45-46.

¹²In any case, such discrimination would have affected mostly exports of

manufactured commodities, which comprised only a small portion of CMEA exports to the West.

¹³Holzman [1962], pp. 135-38.

¹⁴Hewett [1974], p. 45.

¹⁵Marer [1968], pp. 71-72.

¹⁶Hewett [1974], p. 47.

¹⁷However, we realize that Marer's choice was restricted in view of the limited availability of the Hungarian East-West trade price data.

¹⁸Wiles [1969], p. 241.

¹⁹Marer [1972b], p. 61.

²⁰By realistic dollar/ruble settlement exchange rate we mean a rate at which a particular CMEA country would be willing to liquidate her ruble surplus by accepting a payment in dollars, or to settle her ruble deficit by payment in dollars.

²¹The economic opportunity cost of Soviet membership in CMEA greatly exceeds the full opportunity cost in view of the fact that the Soviet Union derives positive non-market benefits (military, political, ideological, and economic) from subsidized trade with Eastern Europe.

²²For more detail see Section IV dealing with the sources of data.

²³Vaňous [1980b] estimates the price elasticity of Western demand for Soviet exports of machinery and equipment at 1.95 and for CMEA Six exports of machinery and equipment at 2.11. The price elasticity of Western demand for exports of industrial consumer goods was estimated at 1.95 in the case of the Soviet Union, and 0.89 in the case of the CMEA Six (Table 4, p. 30). Earlier and more detailed study by Vaňous [1978] estimates the price elasticities of Western demand to be between 2 and 3 for machinery and equipment; for industrial consumer goods the estimates of price elasticities were closer to unity except for the Soviet Union, for which it was estimated to lie above 3 (Table 1, p. 10 and Table 4, p. 13). However, these estimates are applicable only to marginal changes in the volume of trade; for any sharp increase in the volume of exports the elasticities would probably be well below unity.

²⁴For more detailed description of the calculation of discounts from wmp's see Appendix II which deals with an alternative method of derivation of dollar/ruble exchange rates in the absence of a sample of traded commodities.

²⁵Unit values are the cost of a commodity per unit weight or size (metric ton, square meter, cubic meter, hectoliter, etc.). Unit values are notoriously imprecise proxies for unit prices of manufactured commodities because of wide variety and considerable differentiation of manufactured commodities, because of technological improvements, and because of falling weight of manufactured commodities (especially machinery) due to the use of new materials, etc. For example, consider the commodity category called electric calculators; the unit price of a calculator is likely to be very different for a small hand calculator compared to a large office desk model with a printer. This is an example when a comparison of unit values would result in an incorrect conclusion because the difference in unit values of calculators exported to two countries has nothing to do with price discrimination and is entirely due to the fact that the commodity category called electric calculators is not sufficiently homogeneous.

Early studies of price discrimination by Menderhausen [1959,1960] were criticized by Abramov [1963] for identifying average unit values with prices when in fact the commodity categories used by Menderhausen were viewed as too heterogeneous. We attempted to define the commodity categories to be as homogeneous as the published Soviet official foreign trade statistics would permit.

²⁶The example of the former were pesticides and synthetic resins; the example of the latter were rubber tires (measured in pieces, thus making no distinction between tires of different size) and cable and wire (measured in kilometers, thus ignoring the fact that cable and wire can have different diameter).

²⁷I.e., the new estimate of the derived dollar/ruble exchange rate = $\frac{[(\text{initial country estimate} \times \text{sample size in percent}) + (\text{average estimate for the CMEA Six} \times \text{share of commodities omitted from the sample})]}{100}$.

²⁸Kostinsky [1974], pp. 69 and 71, documents that most of Soviet imports of ores and metals from Czechoslovakia were in fact imports of uranium ores. In addition, both East Germany and Hungary are known to produce uranium ores. Though the Soviet import statistics show no imports of ores, the presence of large "unspecified" import residuals in the case of these two countries (even after taking Soviet imports of arms into account) suggests the presence of uranium ore imports. Kostinsky estimates that in the late sixties Soviet imports of uranium ores from the above three countries amounted to about 170 million rubles annually, i.e., around one third of the total Soviet imports of non-food raw materials from these three countries.

²⁹The only country for which some information on the proportion of hard-currency trade in her total intra-CMEA trade is available is Hungary. Vanous [1976], p. F-3, estimates that up to the end of the 1960's less than 4 percent of Hungarian trade with CMEA was transacted in hard currencies and at wmp's.

During 1970-74 between 2.7 and 6.3 percent of Hungarian exports to CMEA and 1.4 to 4.2 percent of Hungarian imports from CMEA was directly transacted in dollars. In addition, indirect Hungarian hard-currency exports (re-exports and other transactions involving Western brokers) to CMEA ranged between 0.1 and 4.9 percent, while for imports the range was between 1.4 and 4.2 percent of total imports originating from the CMEA countries.

Alternative estimates of Hungarian intra-CMEA hard-currency trade are available in Kohn and Lang [1977], pp. 145 and 151, and Marer [1977], pp. 565-6. According to these estimates, during 1970-75 Hungarian hard-currency exports to CMEA amounted to about 7 percent of total exports to CMEA, and for imports the corresponding percentage was about 6 percent.

³⁰See Table 12 in Section VIII.

³¹In 1972, the calculation according to equation (12) would yield $0.10 \times 0.83 \times (-0.10) = -0.0083$, i.e., about 0.8 percent error; in 1974 it would have amounted to $0.10 \times 0.76 \times (-0.72) = -0.055$, i.e., an error of 5.5 percent.

³²See Table 12 in Section VIII.

³³CTN stands for CMEA Trade Nomenclature, which is different from the United Nations' Standard International Trade Classification (SITC).

³⁴For more detail see Marer [1972a], pp. 309-22 and 365-67.

³⁵KAA [1978], pp. 44-62; KSE [1979], pp. 449-57.

³⁶More precisely, we extended the estimates of Soviet unit values in trade with individual CMEA countries on the assumption that they all grew at the same rate as the Hungarian ruble trade unit values. This assumption is clearly preferable to using actual absolute Hungarian unit values in ruble trade as a substitute for Soviet unit values in intra-CMEA trade in view of the different degree of preferential trade treatment granted by the Soviet Union to individual CMEA countries depending on the amount of non-market benefits available to the Soviet Union from these countries.

³⁷KAA [1978], pp. 44-62, 67-68; KSE [1979], pp. 449-57.

³⁸IFS [monthly], section on Commodity Prices.

³⁹See Marer [1972b], pp. 8-13, 34-36, 86-88.

⁴⁰To be fair, Marer [1972b], pp. 8 and 11, stresses this problem when he refers to a CMEA study on the intra-CMEA ftp/wmp ratios done in the early 1960's and to his own [1968] study. E.g., the CMEA study stressed that "these (intra-CMEA ftp/wmp) ratios understate the discrepancy between CMEA and world market

prices, since the quality of goods traded in the bloc tends to be lower than those traded on Western markets. This bias is particularly important in the machinery category where not all quality aspects could be taken into account adequately when identifying comparable Western prices" (p.8).

⁴¹Here and below we are using the term wmp's instead of prices in Soviet trade with the Developed West.

⁴²The overall ruble trade balances were converted into dollars using the derived dollar/ruble exchange rates for Soviet imports from individual CMEA countries presented in Tables A-13 through A-18 in Appendix IV, and the rates for Soviet imports from the CMEA Six presented in Table I in Section V.

⁴³E.g., Hewett [1974]. p.90, estimates that relative to 1960 Soviet terms of trade with Eastern Europe declined 11 to 21 percent during 1965-70. Official Soviet estimates also reported in Hewett put the decline into the range of 10 to 19 percent.

⁴⁴According to the rather vague CMEA rules for price formation in effect until the end of 1974, intra-CMEA ftp's were based on lagged averages of wmp's, periodically (every five years) revised and purged of various negative influences of the world capitalist market, such as monopoly influences, temporary speculative trends, short-term and cyclical influences, etc. In 1975 intra-CMEA ftp's were supposed to be based on the lagged average of wmp's during the period 1972-74; in 1976 the base period was supposed to cover years 1972-75; from 1977 on intra-CMEA ftp's are supposedly constructed on the basis of the lagged five-year moving average of wmp's.

⁴⁵Cumulative Soviet imports of machinery and equipment from the Developed West and the cumulative Soviet trade deficit with the Developed West were calculated on the basis of the data in Vaňous [1980a], Tables 60 and 150.

⁴⁶The overall Soviet import price index from the Developed West was constructed by Vaňous as a part of his [1980b] study for the W.E.F.A. SEEMOD Project. The values of the index are as follows:

1960 = 101	1965 = 99	1970 = 100	1975 = 208
1961 = 96	1966 = 100	1971 = 105	1976 = 196
1962 = 93	1967 = 97	1972 = 109	1977 = 207
1963 = 95	1968 = 94	1973 = 133	1978 = 224
1964 = 99	1969 = 96	1974 = 187	

⁴⁷In particular, we relied on quotations of 3-month Eurodollar interest rates (annual averages) published in various issues of Euromoney and in Paul Einzig, The Eurodollar System (London:Macmillan, 1970, 4th Edition). The actual discount table looked as follows:

1960 = 3.5976	1965 = 2.9616	1970 = 2.1575	1975 = 1.4586
1961 = 3.4536	1966 = 2.8227	1971 = 1.9081	1976 = 1.3629
1962 = 3.3342	1967 = 2.6562	1972 = 1.8653	1977 = 1.2909

1963 = 3.2134	1968 = 2.5186	1973 = 1.7688	1978 = 1.2175
1964 = 3.0922	1969 = 2.3680	1974 = 1.6192	1979 = 1.1196
			1980 = 1.0000

⁴⁸In addition, this also appears to be the case of Poland in 1964, but the amount of implicit taxes (2 million dollars) is not significant.

⁴⁹The respective 1970 populations for individual Eastern European countries were: Bulgaria - 8.490 million people, Czechoslovakia - 14.334, East Germany - 17.058, Hungary - 10.338, Poland - 32.526, Romania - 20.250, the CMEA Six taken together - 102.997.

⁵⁰The recent developments in Poland will undoubtedly serve as an important signal about what might happen in the rest of Eastern Europe if the Soviet Union sharply increases its prices for exported fuels and thus inevitably forces at least a temporary decline in Eastern European living standards.

⁵¹The level of implicit subsidies in 1979 was estimated as the difference between the projected dollar trade balance (\$ 10460 million) and the dollar value of the overall ruble trade balance (R 1070 million times the settlement dollar/ruble exchange rate of 0.85). Similarly, 1980 subsidies were calculated as \$ 21080 million minus (R 1300 million times 0.86).

⁵²See footnote 44 for more detail.

⁵³On the other hand, as footnote 50 point out, there are strong incentives for the Soviet Union to refrain from sharply increasing its prices for exported fuels in 1981.

⁵⁴E.g., Marer [1977], p. 566, points out that already in 1975 Hungary had to pay for about 10 percent of her crude oil imports from the Soviet Union (deliveries above the originally planned shipments) in dollars.

⁵⁵See, e.g., Hewett [1974], p. 53; Marer [1972b], p. 57; Vaňous [1980c], pp. 9-12.

⁵⁶See, e.g., Vaňous [1980c], pp. 9-17.

⁵⁷Commercial (realistic) exchange rates are used in the official Hungarian statistical publications on foreign trade since 1976 and in the official Romanian statistical materials supplied to the IMF, which began to be published in June 1980 in IMF's International Financial Statistics.

⁵⁸E.g., in 1977 Soviet imports from the CMEA Six had the following commodity composition: machinery and equipment - 53 percent, fuels - 3 percent, non-food raw materials - 14 percent, food and raw materials for food - 10 percent, and industrial consumer goods - 20 percent. On the other hand,

during the same year intra-CMEA Six trade consisted of the following commodity shares: machinery and equipment - 57 percent, fuels - 6 percent, non-food raw materials - 20 percent, food and raw materials for food - 7 percent, and industrial consumer goods - 10 percent. For more detail see Vaňous [1980a], Tables 58, 62, and 79.

⁵⁹The reason why the ftp's of fuels, non-food raw materials, and food and raw materials for food have to be increased by 59, 39, and 25 percent, respectively, is that these percentage adjustments are based on the initial actual ftp's, i.e., these adjustments are calculated as $(1+0.63)$, $(1+0.72)$, and $(1+0.80)$.

⁶⁰E.g., in the case of fuels, intra-CMEA ftp's of oil are much lower relative to wmp's of oil than in the case of prices for coal and coke. Consequently, intra-CMEA ftp's of oil should be increased relative to ftp's of coal and coke even though both fall into the same broad commodity category -- fuels.

⁶¹These adjustments might take the form of adjustments made in Appendix II in an effort to take into account the differences in the quality of machinery, equipment, and industrial consumer goods imported by the Soviet Union from individual CMEA countries.

⁶²Marer [1972b], p. 86, estimates that at official exchange rates average 1960 CMEA contract ftp's of machinery and equipment exceeded 1957-61 wmp's by 39 percent. Because the average level of wmp's of machinery and equipment during 1957-61 coincided with their 1960 level, Marer's comparison is also relevant for the comparison of 1960 intra-CMEA ftp's to 1960 wmp's. In the absence of a specific estimate of the above ratio of machinery prices for the USSR (only estimates for six Eastern European countries were available), we assumed that the average level of Soviet export prices of machinery and equipment to the CMEA Six was equal to the average level of export prices of these goods from the CMEA Six. Finally, since we compare the ratio of intra-CMEA ruble ftp's to prevailing dollar wmp's, we had to divide Marer's estimate of 1.39 by the official dollar/ruble exchange rate of 1.1111, thus arriving at the ratio of 1.25 appearing in the denominator of equation (13).

⁶³See Marer [1972b], pp. 41, 37-40.

⁶⁴Marer [1972b], p. 86; all these ratios were adjusted along the same lines by dividing them by a factor 1.1111 in order to compare intra-CMEA ruble price levels and world market dollar price levels.

⁶⁵Hewett [1974], pp. 72-73 and 78-79; Hewett [1979], pp. 8 and 9; Dietz [1979], pp. 30-31; KAA [1978], pp. 18-21, 26, 31; KSE [1979], pp. 443, 445-46, 449-57.

⁶⁶KAA [1978], pp. 18-21, 27-28; KSE [1979], pp. 443, 445-6.

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PART IV

"THE DETERMINANTS OF IMPLICIT SOVIET
TRADE SUBSIDIES TO EASTERN EUROPE:
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by

Michael Marrese and Jan Vaňous

A b s t r a c t

In the introduction of the paper, the authors set forth three stylized observations above the pattern of trade within the Council For Mutual Economic Assistance (CMEA) which motivated their research. The purpose of the paper is twofold: 1) to substantiate the observation that the Soviet Union has been subsidizing Eastern Europe and 2) to explain the interrelationships among the three observations. The authors claim that the Soviet Union's dominant position relative to Eastern European countries both explains the existence of different sets of terms of trade and enables the Soviet Union to obtain Eastern European allegiance which is used as an input in the production of security services.

Section I presents the methodology for computing the implicit trade subsidies. In the presence of incomplete sample coverage and unbalanced trade (which is typically the case in actual empirical work), the calculation of subsidies must be done in three steps. First, for each CMEA partner country, realistic dollar/ruble conversion rates must be calculated both for exports and for imports in each commodity category. Second, using these conversion rates, Soviet ruble trade flows with each CMEA country are converted into dollars. Finally, the subsidies are calculated, correcting for a non-zero overall Soviet ruble trade balance. In addition to presenting the methodology of calculations, Section I mentions problems encountered in the collection of data and the calculations which had to be resolved.

Section II discusses the trends in implicit trade subsidies and their distribution among individual East European countries. The authors' calculations show that the size of implicit Soviet trade subsidies granted to Eastern Europe exhibit significant variations over time. Five different phases in the level of implicit trade subsidies are noted and linked with changes in price behavior both within CMEA and on the world market. The distribution of implicit subsidies measured in current and constant 1970 dollars, and also the present value of implicit subsidies in 1980 dollars, is given in Section III. All three of these measures verify the peculiar behavior of subsidies in the case of Bulgaria and Romania.

After dividing the 19 year period into four subperiods characterized by differing price behavior, the authors analyze the distribution of subsidies among individual East European countries. They present the ratio of subsidy to total Soviet exports, the total subsidy in constant 1970 dollars, the country shares of total subsidy in constant 1970 dollars, the per capita average annual subsidy in constant 1970 dollars, the present value of subsidy in 1980 dollars,

and the present value of per capita average annual subsidy in 1980 dollars. The authors use these measures to rank the countries according to their subsidy treatment, both on an absolute and on a per capita basis. They find East Germany and Czechoslovakia are unambiguously the most heavily subsidized countries and Romania unambiguously the least subsidized.

In Section III, the authors discuss the unconventional gains from trade which the Soviet Union acquires from CMEA countries. They first explain why the analysis of Romania is not included in the rest of the paper. Implicit Soviet taxes and subsidies to Romania are relatively minor, which the authors attribute to Romania's unwillingness to supply non-market benefits to the Soviet Union. The authors then discuss the potential benefits of each country for the Soviet Union in terms of land area, population, number of Soviet divisions stationed in the country, instances of domestic instability and lengths of strategic borders. The countries are then ranked according to their importance to the Soviet Union with respect to non-market benefits.

Next, the authors address the question of why a trade-related subsidy rather than a direct grant is used. They argue that unconventional gains from trade arise because of conflicts among different groups in society, which motivate government officials to choose bilateral preferential trade treatment as a hidden way of generating non-market benefits.

Section IV presents the econometric analysis of the implicit Soviet trade subsidies to the CMEA Four. The analysis consists of two parts. First, the aggregate implicit subsidy is the dependent variable in a log-linear specification which takes into account a time trend, short run economic tension within the Soviet Union and the institutional rigidity of the CMEA pricing formula. The authors conclude from the first part that the Soviet Union is substantially increasing subsidies to the CMEA Four annually for a relatively constant quantity of non-market benefits. In the second part of the econometric analysis, country specific subsidies are the dependent variables in a non-linear maximum likelihood full information specification designed to distribute the predicted values and the residuals from part one. The results confirm the analysis of Section II, namely that East Germany is the most heavily subsidized country, followed by Czechoslovakia, Poland and Hungary.

The question of the extent to which implicit Soviet trade subsidies occurred because of CMEA institutional price rigidity or because of a conscious Soviet decision to subsidize, can be answered fully only by examining at the commodity category level of aggregation: each country's CMEA export-import mix, each country's non-CMEA export-import mix, evidence of price discrimination within CMEA, and differences between relative wmp's and relative intra-CMEA ftp's. Nonetheless, the above-mentioned econometric specification does allow the authors to decompose the real value of implicit Soviet trade subsidies to the CMEA Four in a manner which yields two results supporting the notion that implicit trade subsidies occurred because of conscious Soviet decisions.

Section V offers possible explanations for the presence of implicit Soviet trade subsidies other than those which have been discussed in the paper.

Preliminary, abbreviated
draft--a complete draft
is forthcoming

THE DETERMINANTS OF IMPLICIT SOVIET
TRADE SUBSIDIES TO EASTERN EUROPE:
AN ECONOMETRIC ANALYSIS

by

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PERMISSION FROM THE AUTHORS

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THE DETERMINANTS OF IMPLICIT SOVIET
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by

Michael Marrese and Jan Váňous

Our research on the benefits and costs to the Soviet Union of trade with Eastern European countries started from three stylized observations about the pattern of trade within the Council for Mutual Economic Assistance (CMEA) for the period 1960-80:

- (i) the Soviet Union has been "subsidizing" certain Eastern European countries by exporting "hard goods" (fuels, non-food raw materials, food and raw materials for food) at prices below world market prices in exchange for imports of "soft goods" (machinery, equipment and industrial consumer goods) at prices above world market prices, especially if account is taken of the relatively lower quality of Eastern European manufactures in comparison with their Western counterparts;
- (ii) within CMEA, trade between any two Eastern European countries exhibits balanced trade in "hard goods" and balanced trade in "soft goods";
- (iii) Soviet national security is produced from a combination of Soviet troops and military hardware within the Soviet Union, Soviet troops and military hardware stationed in Eastern Europe, and the allegiance of Eastern European countries.

The purpose of this paper is to substantiate observation (i) and to explain the interrelationships among all three observations. The first observation indicates that two different sets of terms of trade exist simultaneously for the Soviet Union--prevailing terms of trade on the world market as well as what appear to be inferior terms of trade with Eastern European countries. Section I discusses the methodology of calculating the subsidies implicit in the relative differences between world market prices and CMEA prices. Section II presents the implicit subsidies in nominal, real and relative terms for 1960-78.

The second observation implies that Soviet trade behavior within CMEA is unique and therefore some special aspect of the Soviet Union's relationship to Eastern Europe may hold the key to understanding the presence of the two sets of terms of trade. The third observation suggests that this special aspect is the Soviet Union's dominant position relative to Eastern European countries, which allows the Soviet Union to obtain Eastern European allegiance and utilize it as a substitute for Soviet inputs of labor and capital in the production of security services. Unconventional gains from trade, described in Section III, explain the Soviet Union's use of implicit trade subsidies to generate allegiance. We argue that the Soviet Union's strategy of covertly paying for non-market benefits with implicit trade subsidies is responsible for the multiple set of terms of trade which the Soviet Union faces. The analysis of Romania and Bulgaria differ from that for the other Eastern European countries in this section.

The econometric analysis in sections IV and V focuses on the explanatory factors behind the total subsidies to four CMEA countries--Czechoslovakia, the German Democratic Republic (GDR), Hungary and Poland--and on the distribution of this aggregate subsidy to these countries. Analysis of Bulgaria also appears in these two sections.

Throughout the entire paper, the term CMEA Six will refer to Bulgaria, Czechoslovakia, GDR, Hungary, Poland and Romania. CMEA Five refers to CMEA Six minus Romania. CMEA Four refers to CMEA Five minus Bulgaria. The country code used in all tables is: B=Bulgaria, C=Czechoslovakia, GDR, H=Hungary, P=Poland, and R=Romania.

Section I: Methodology of Calculating Implicit Trade Subsidies

Consider the following notation:

- B_t^R = $VX_t^R - VM_t^R$ = overall Soviet trade balance with a particular CMEA partner country in year t, calculated at intra-CMEA foreign trade prices (ftp's) and measured in rubles;
- B_t^S = $VX_t^S - VM_t^S$ = overall Soviet trade balance with a particular CMEA country in year t, calculated at world market prices (wmp's) and measured in dollars;
- B_{jt}^S = $VX_{jt}^S - VM_{jt}^S$ = Soviet trade balance in commodity category j in year t with a particular CMEA country, calculated at world market prices (wmp's) and measured in dollars;
- EM_{jt}, EX_{jt} = derived dollar/ruble exchange rate (dollars per one ruble) for Soviet imports and exports of goods in commodity category j in year t with a particular CMEA country;
- F_t = settlement dollar/ruble exchange rate (dollar per one ruble), i.e., the rate at which trade surpluses or deficits denominated in rubles can be eliminated by dollar payments to or from the USSR;
- PM_{ijt}^R, PX_{ijt}^R = unit f.o.b. price of Soviet imports and exports of commodity i in commodity category j in year t with a particular CMEA country, denominated in rubles; referred to as intra-CMEA ftp's
- PM_{ijt}^S, PX_{ijt}^S = unit f.o.b. world market price of Soviet imports and exports (Soviet import price from and export price to the Developed West) of commodity i in commodity category j in year t, denominated in dollars; referred to as wmp's
- QM_{ijt}, QX_{ijt} = quantity of Soviet imports and exports of commodity i in commodity category j in year t from and to a particular CMEA country,

measured in metric tons or other physical units;

$S_t^{\$}$ = implicit Soviet trade subsidies to a particular CMEA country in year t, measured in dollars;

VM_{ijt}^R, VX_{ijt}^R = value of Soviet imports and exports of goods in commodity category j in year t from and to a particular CMEA country, measured in rubles;

VM_{ijt}^R = $QM_{ijt} \cdot PM_{ijt}^R$ = value of Soviet imports of commodity i in commodity category j in year t from a particular CMEA country, measured in rubles;

VX_{ijt}^R = $QX_{ijt} \cdot PX_{ijt}^R$ = value of Soviet exports of commodity i in commodity category j in year t to a particular CMEA country, measured in rubles;

$VM_{ijt}^{\$}, VX_{ijt}^{\$}$ = value of Soviet imports and exports of goods in commodity category j in year t from and to a particular CMEA country, measured in dollars;

$VM_{ijt}^{\$}$ = $QM_{ijt} \cdot PM_{ijt}^{\$}$ = value of Soviet imports of commodity i in commodity category j in year t from a particular CMEA country, measured in dollars;

$VX_{ijt}^{\$}$ = $QX_{ijt} \cdot PX_{ijt}^{\$}$ = value of Soviet exports of commodity i in commodity category j in year t to a particular CMEA country, measured in dollars.

If we had information on all physical quantities of commodities traded by the USSR with each CMEA country, i.e., 100 percent coverage of the sample of QM_{ijt} 's and QX_{ijt} 's, and if the USSR always maintained a zero overall ruble trade balance with each partner country, then the calculation of the implicit

Soviet trade subsidies would be very simple. In particular, the implicit Soviet trade subsidies transferred to a specific CMEA country in year t would equal the overall bilateral trade balance measured in dollars:

$$\begin{aligned}
 S_t^{\$} &= \sum_j \sum_i (QX_{ijt} \cdot PX_{ijt}^{\$}) - \sum_j \sum_i (QM_{ijt} \cdot PM_{ijt}^{\$}) = \sum_j VX_{jt}^{\$} - \sum_j VM_{jt}^{\$} = \\
 &= VX_t^{\$} - VM_t^{\$} = \sum_j B_{jt}^{\$} = B_t^{\$}, \quad \dots(1) \\
 i &= 1, \dots, n_j \\
 j &= 1, \dots, 5.
 \end{aligned}$$

However, equation (1) cannot be used for the calculation of the implicit Soviet trade subsidies because the above two conditions are typically not satisfied. In actual empirical work the sample of physical quantities of commodities typically has less than 100 percent coverage. In addition, the overall Soviet ruble trade balance is never exactly equal to zero, even though the presence of bilateralism in Soviet trade relations with Eastern Europe tends to reduce large potential imbalances between overall exports and imports.

In the presence of an incomplete sample coverage and unbalanced overall trade, the calculation of the implicit Soviet trade subsidies has to be done in the following three steps. First, for each CMEA partner country, conversion rates have to be derived to translate ruble trade flows calculated at intra-CMEA ftp's into dollar trade flows calculated at wmp's on the basis of a sample of commodities with less than 100 percent coverage. This calculation has to be made separately for exports and imports in each commodity category. The derived conversion rate (in dollars per one ruble) for exports of commodity j to a particular CMEA country is:

$$EX_{jt} = \sum_{i=1}^{m_j} (QX_{ijt} \cdot PX_{ijt}^S) / \sum_{i=1}^{m_j} (QX_{ijt} \cdot PX_{ijt}^R) \quad \dots(2)$$

$$i = 1, \dots, m_j < n_j$$

$$j = 1, \dots, 5$$

and for imports of commodity j the derived conversion rate is:

$$EM_{jt} = \sum_{i=1}^{m_j} (QM_{ijt} \cdot PM_{ijt}^S) / \sum_{i=1}^{m_j} (QM_{ijt} \cdot PM_{ijt}^R) \quad \dots(3)$$

$$i = 1, \dots, m_j < n_j$$

$$j = 1, \dots, 5.$$

Second, using the above conversion rates, Soviet ruble trade flows with each CMEA country are converted into dollars. We assume that the exchange rate calculated on the basis of the available sample of commodities is valid for the entire trade in a given commodity category. Thus the value of exports of commodity j measured at wmp's and in dollars equals

$$VX_{jt}^S = VX_{jt}^R \cdot EX_{jt}, \quad \dots(4)$$

and the value of imports of commodity j equals

$$VM_{jt}^S = VM_{jt}^R \cdot EM_{jt}. \quad \dots(5)$$

Finally, the implicit trade subsidies corrected for non-zero overall Soviet ruble trade balance equal

$$S_t^S = \sum_j (VX_{jt}^S - VM_{jt}^S) - \left[\sum_j (VX_{jt}^R - VM_{jt}^R) \cdot F_t \right] = (VX_t^S - VM_t^S) - [(VX_t^R - VM_t^R) \cdot F_t] = B_t^S - (B_t^R \cdot F_t). \quad \dots(6)$$

Equation (6) has been utilized in our calculation of implicit Soviet trade subsidies.

In the course of the collection of data necessary for the calculation of the subsidies as well as during the calculation itself, numerous problems had to be resolved in the following areas:

- (i) choice of the correct opportunity cost measure for Soviet exports to and imports from Eastern Europe;
- (ii) selection of commodity categories which were sufficiently homogenous;
- (iii) cases of zero sample commodity coverage;
- (iv) cases of poor sample commodity coverage;
- (v) taking account of the presence of trade in dollars and at wmp's between the USSR and individual Eastern European countries;
- (vi) choice of the dollar/ruble settlement exchange rate F_t .

The ways by which we handled these problems are discussed in detail in Vaňous and Marrese [1980c], and will not be dealt with in this paper. Also, a detailed description of the data used in the calculation of implicit Soviet trade subsidies to Eastern Europe and a complete description of the estimation of the derived dollar/ruble exchange rates appear in Vaňous and Marrese [1980c].

Section II: Implicit Soviet Trade Subsidies to Eastern Europe

The components which sum to implicit Soviet trade subsidies to the CMEA Six measured in current dollar are presented in Table 1 below [see equation (6) of section I]. Corresponding calculations for each CMEA country and more detailed information concerning the calculation of these implicit trade subsidies appear in Vaňous and Marrese [1980c]. The information listed in Table 1 is graphed in Figure 1 below. Thus Figure 1 contains the trends in the Soviet commodity trade balances as well as the overall trade balance with the CMEA Six measured in current dollar and at wmp's for 1960-78. In Figure 2 the trend in the overall implicit Soviet trade subsidy to the CMEA Six is compared with the trend in Soviet imports of machinery and equipment from the Developed West and with the overall Soviet dollar trade deficit with the Developed West.

Our calculations show that the size of implicit Soviet trade subsidies granted to Eastern Europe exhibits large variations over time; the subsidies, measured in current dollars, reached their lowest level in 1963 (96 million dollars) and the highest level was reached in 1974 (6265 million dollars). It appears that the increases in the subsidies over time coincide with three events, namely the intra-CMEA ftp revision of 1964-65, a temporary surge in wmp's of primary commodities in 1970-71, and the increase in wmp's of fuels in 1973-74 through the rest of the period. Five different phases in the level of implicit trade subsidies can be recognized. During the first phase (1960-64), the subsidies averaged about 186 million dollars annually.

Table 1. Calculation of the Implicit Trade Subsidies Granted by the Soviet Union to the CMEA Six
(in Millions of Current Dollars)

Year	Machinery Trade Balance	Fuel Trade Balance	Non-Food Raw Material Trade Balance	Food Trade Balance	Industrial Consumer Goods Trade Balance	Total Trade Balance	Total Ruble Balance Converted Into Dollars	Implicit Trade Subsidy
1960	-258	101	513	276	-235	397	154	243
1961	-199	148	546	130	-250	375	191	184
1962	-259	222	508	277	-306	443	208	235
1963	-348	272	397	187	-399	109	13	96
1964	-352	331	612	24	-405	211	38	173
1965	-406	341	801	-35	-408	294	-75	369
1966	-289	365	919	33	-468	560	127	434
1967	-354	401	845	35	-534	393	-33	427
1968	-322	471	1000	-10	-582	557	2	555
1969	-397	543	1155	6	-623	683	99	585
1970	-457	659	1757	-132	-741	1086	49	1037
1971	-592	944	1525	-109	-885	883	-29	912
1972	-976	1053	1448	-470	-1078	-23	-685	662
1973	-1147	1770	2208	-516	-1281	1034	-594	1628
1974	-1223	5335	4077	-305	-1519	6366	101	6265
1975	-1517	5782	3809	-698	-1578	5797	472	5325
1976	-1638	6922	3786	-1094	-1666	6311	714	5596
1977	-2022	8120	4360	-1113	-1918	7128	1190	5938
1978	-3491	8487	4465	-1296	-2265	5900	146	5754

Note: Total Trade Balance = Sum of Commodity Trade Balances Measured at World Market Prices;
Implicit Trade Subsidy = Total Trade Balance minus Total Ruble Trade Balance Converted into Dollars.

Figure 1. Soviet Commodity Trade Balances and Overall Trade Balance with the CMEA Six Valued at World Market Prices (in Millions of Current Dollars)

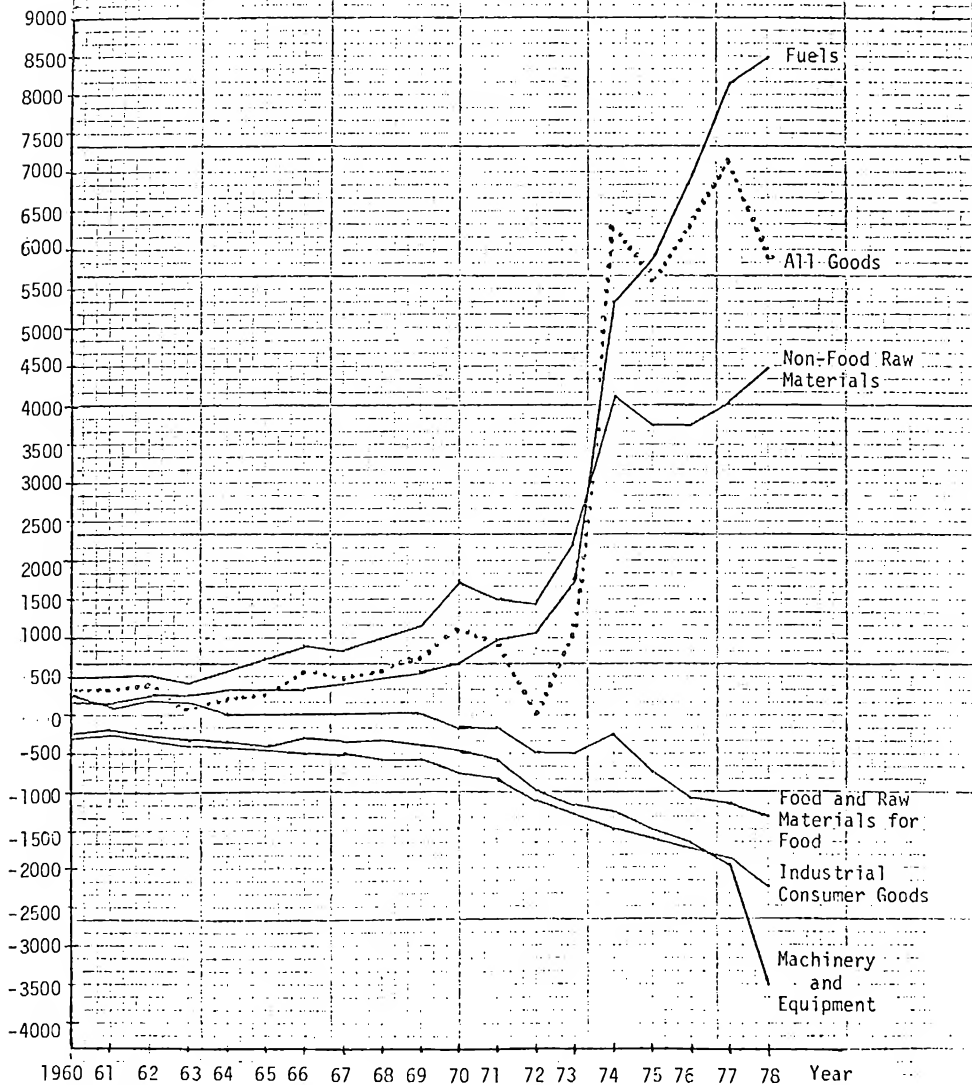
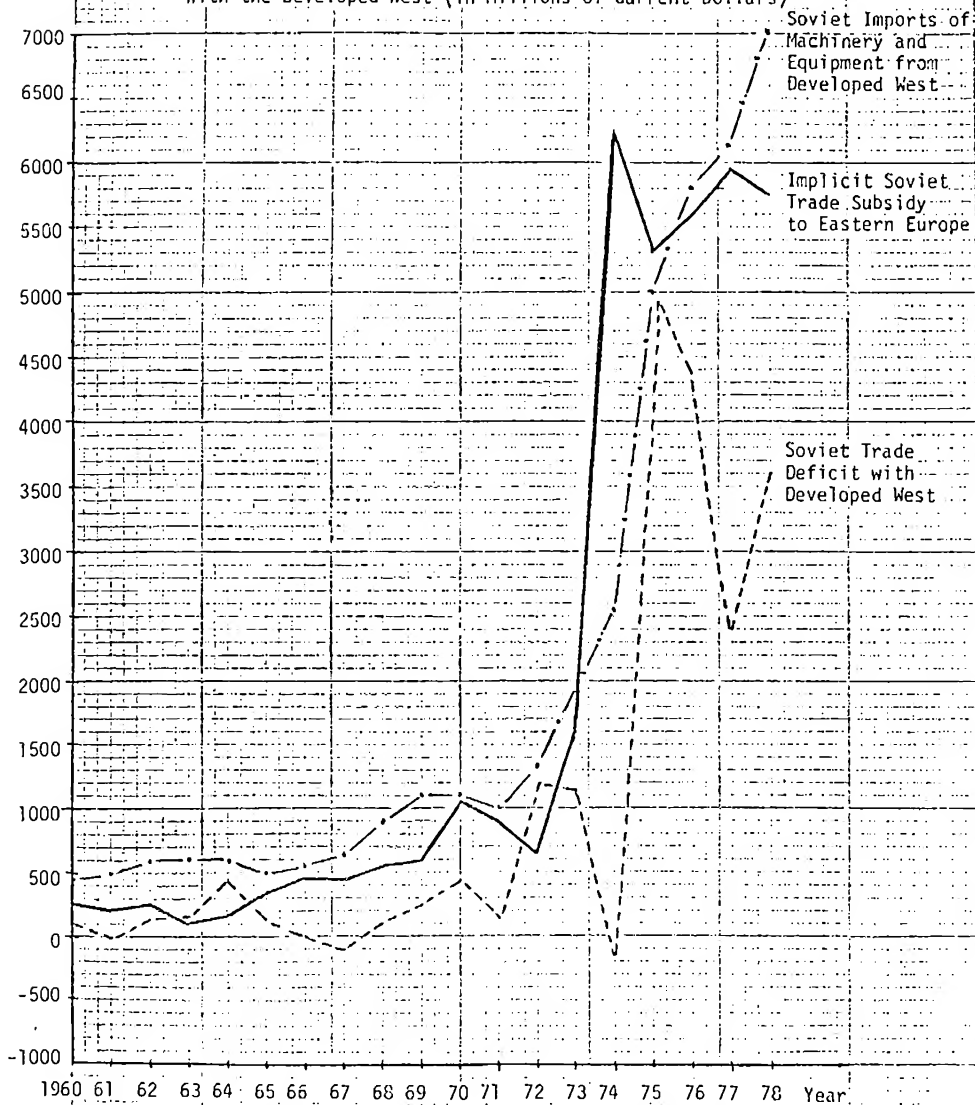


Figure 2. Implicit Soviet Trade Subsidy to Eastern Europe Compared to Soviet Machinery Imports from the Developed West and Soviet Trade Deficit with the Developed West (in Millions of Current Dollars)



During the second phase, after the 1964-65 intra-CMEA ftp revision took place, the subsidies averaged about 474 million dollars annually due to the deterioration in the Soviet terms of trade with Eastern Europe vis-à-vis the trends in relative wmp's.¹ As a result of the temporary surge in wmp's of primary commodities in 1970-71, the average level of implicit subsidies reached about 975 million dollars annually during the third phase (1970-71). In 1972 and probably throughout most of 1973 these subsidies were in the 600 to 800 million dollar range; thus during the fourth phase (1972-73) the subsidies were close to the trend line observed during the period 1965-69. The rapid growth of wmp's of fuels in late 1973 and in 1974 pushed the level of subsidies to about 1628 million dollars in 1973 and to an average annual level of about 5776 million dollars during the fifth phase (1974-78). It is interesting to note that the 1975 intra-CMEA ftp reform did not significantly reduce the level of the subsidies below the all-time high value of 6265 million dollars reached in 1974 in spite of the fact that Soviet prices of fuel exports to Eastern Europe increased by about 85 percent relative to 1974.²

Figure 2 is of interest because it indicates the size of the subsidies in relative terms by comparing their magnitude to the size of Soviet imports of machinery and equipment from the Developed West and to the overall Soviet trade deficit with the Developed West. During 1960-78, the undiscounted cumulative subsidies in current dollars amounted to about 36.4 billion dollars; on the other hand, the undiscounted Soviet cumulative imports of machinery and equipment from the Developed West in current dollars amounted to 38.4 billion dollars, and the overall Soviet cumulative deficit with the Developed West amounted to about 19.4 billion dollars.³ This, however, should not be

interpreted as suggesting that the Soviet Union, by eliminating the subsidies, could have doubled its imports of machinery and equipment from the Developed West or could have achieved a 17 billion dollar surplus with the Developed West instead of a deficit of 194 billion. Any elimination of subsidies would have required a substantial increase in Soviet defense expenditure both at home and abroad in order to maintain the same level of security because Soviet subsidies have generated increased allegiance in Eastern Europe which is one of the inputs in the Soviet security production function.

While the trend in implicit Soviet trade subsidies to the CMEA Six taken together is not that surprising, the distribution of implicit subsidies among individual Eastern European countries seems to be startling in several respects. Different measures of the distribution of implicit subsidies during 1960-78 are presented in Table 2 below. Table 2 consists of three parts: estimates of subsidies measured in current dollars, then estimates of the size and distribution of these subsidies measured in constant 1970 dollars, and finally the present value of implicit subsidies in 1980 dollars. In addition, the trend in implicit subsidies measured in current dollars is illustrated in Figure 3, while the trend in subsidies measured in constant 1970 dollars is illustrated in Figure 4.

An estimate of subsidies in constant 1970 dollars is included because it is a better indicator of the extent of Soviet transfer of real resources to Eastern Europe than the estimate in current dollars. The overall Soviet import price index from the Developed West was selected as a deflator because the authors judged it to be a good measure of the changing opportunity cost of a forgone dollar of export earnings in and hence also of imports from the Developed West.⁴ Present value of implicit subsidies in 1980 dollars was

Table 2. The Distribution of Implicit Soviet Trade Subsidies Among Individual Eastern European Countries (in Millions of Dollars)

Year	Bulgaria	Czecho- slovakia	East Germany	Hungary	Poland	Romania	CMEA Six
<u>I n C u r r e n t D o l l a r s</u>							
1960	-77.5	67.4	178.7	46.5	52.9	-24.7	243.4
1961	-72.7	48.8	171.5	64.6	16.2	-44.2	184.1
1962	-60.5	60.9	212.0	48.0	33.2	-58.5	235.2
1963	-112.8	37.3	158.1	40.5	28.8	-56.3	95.6
1964	-101.7	46.0	242.0	35.2	-1.9	-46.5	173.0
1965	-73.1	92.4	302.9	52.7	13.1	-19.2	368.7
1966	-96.0	108.9	321.9	56.3	70.5	-27.9	433.7
1967	-91.2	124.3	260.9	62.3	95.6	-25.4	426.5
1968	-89.2	162.5	288.1	98.5	110.2	-15.3	554.8
1969	-54.8	163.3	282.3	93.4	124.1	-23.4	584.9
1970	6.0	203.1	456.7	158.1	169.5	33.4	1036.7
1971	-14.7	157.7	426.1	142.1	164.7	36.6	912.5
1972	-32.6	109.1	329.6	112.6	131.0	11.9	661.7
1973	159.8	250.3	688.9	226.8	300.4	1.8	1628.2
1974	1081.3	1174.2	2022.6	876.9	1067.1	42.9	6264.9
1975	919.3	1096.9	1665.0	597.9	1027.3	19.1	5325.5
1976	876.8	1195.4	1786.4	671.1	1021.4	45.4	5596.3
1977	1014.8	1225.5	1896.0	644.6	1106.3	50.4	5937.6
1978	1087.1	1086.4	1913.9	660.6	897.0	109.1	5754.1
<u>I n C o n s t a n t 1 9 7 0 D o l l a r s</u>							
1960	-76.7	66.7	177.0	46.0	52.4	-24.4	241.0
1961	-75.7	50.8	178.6	67.3	16.8	-46.1	191.8
1962	-65.1	65.5	228.0	51.7	35.7	-62.9	252.9
1963	-118.7	39.3	166.4	42.7	30.3	-59.2	100.7
1964	-102.7	46.5	244.4	35.5	-1.9	-47.0	174.7
1965	-73.9	93.3	305.0	53.2	13.3	-19.4	372.5
1966	-96.0	108.9	321.9	56.3	70.5	-27.9	433.7
1967	-94.0	128.2	269.0	64.2	98.5	-26.2	439.7
1968	-94.9	172.9	306.5	104.8	117.2	-16.3	590.2
1969	-57.0	170.1	294.0	97.3	129.2	-24.4	609.2
1970	6.0	203.1	466.7	158.1	169.5	33.4	1036.7
1971	-14.0	150.2	405.8	135.3	156.9	34.8	869.0
1972	-29.9	109.1	302.4	103.3	120.2	10.9	607.0
1973	120.2	188.2	517.9	170.6	225.9	1.4	1224.2
1974	578.2	627.9	1031.6	468.9	570.6	23.0	3350.2
1975	442.0	527.4	800.5	287.4	493.9	9.2	2560.3
1976	447.3	609.9	911.4	342.4	521.1	23.1	2855.3
1977	490.2	592.0	915.9	311.4	534.5	24.3	2858.4
1978	485.3	485.0	854.4	294.9	400.4	48.7	2558.8

Table 2 Continued

Year	Bulgaria	Czecho- slovakia	East Germany	Hungary	Poland	Romania	CMEA Six
<u>Present Value of Implicit Subsidies in 1980 Dollars</u>							
1960	-278.7	242.3	643.0	167.2	190.4	-88.7	875.5
1961	-251.0	168.6	592.1	223.0	55.8	-152.7	635.8
1962	-201.9	203.2	707.0	160.2	110.7	-195.0	784.2
1963	-362.5	119.8	508.0	130.3	92.4	-180.8	307.3
1964	-314.5	142.2	748.2	108.8	-6.0	-143.9	534.8
1965	-216.6	273.5	897.0	156.0	38.9	-56.8	1092.0
1966	-270.9	307.3	908.6	159.0	199.0	-78.8	1224.2
1967	-242.2	330.2	693.0	165.4	253.9	-67.4	1132.9
1968	-224.7	409.3	725.6	248.0	277.5	-38.5	1397.2
1969	-129.7	386.6	668.4	221.2	293.8	-55.4	1385.0
1970	13.0	438.2	1006.9	341.1	365.6	72.0	2236.7
1971	-29.3	313.6	847.1	282.5	327.4	72.7	1814.1
1972	-60.8	203.5	614.9	210.0	244.4	22.2	1234.2
1973	282.7	442.8	1218.5	401.2	531.4	3.2	2879.9
1974	1750.8	1901.2	3275.0	1419.8	1727.8	69.5	10144.1
1975	1340.9	1600.0	2428.6	872.0	1498.4	27.9	7767.7
1976	1194.9	1629.2	2434.6	914.6	1392.0	61.8	7627.2
1977	1310.0	1581.9	2447.6	832.2	1428.2	65.0	7664.8
1978	1323.5	1322.7	2330.1	804.3	1092.1	132.9	7005.6

Figure 3. The Trend in Implicit Soviet Trade Subsidies Granted to Individual Eastern European Countries (in Millions of Current Dollars)

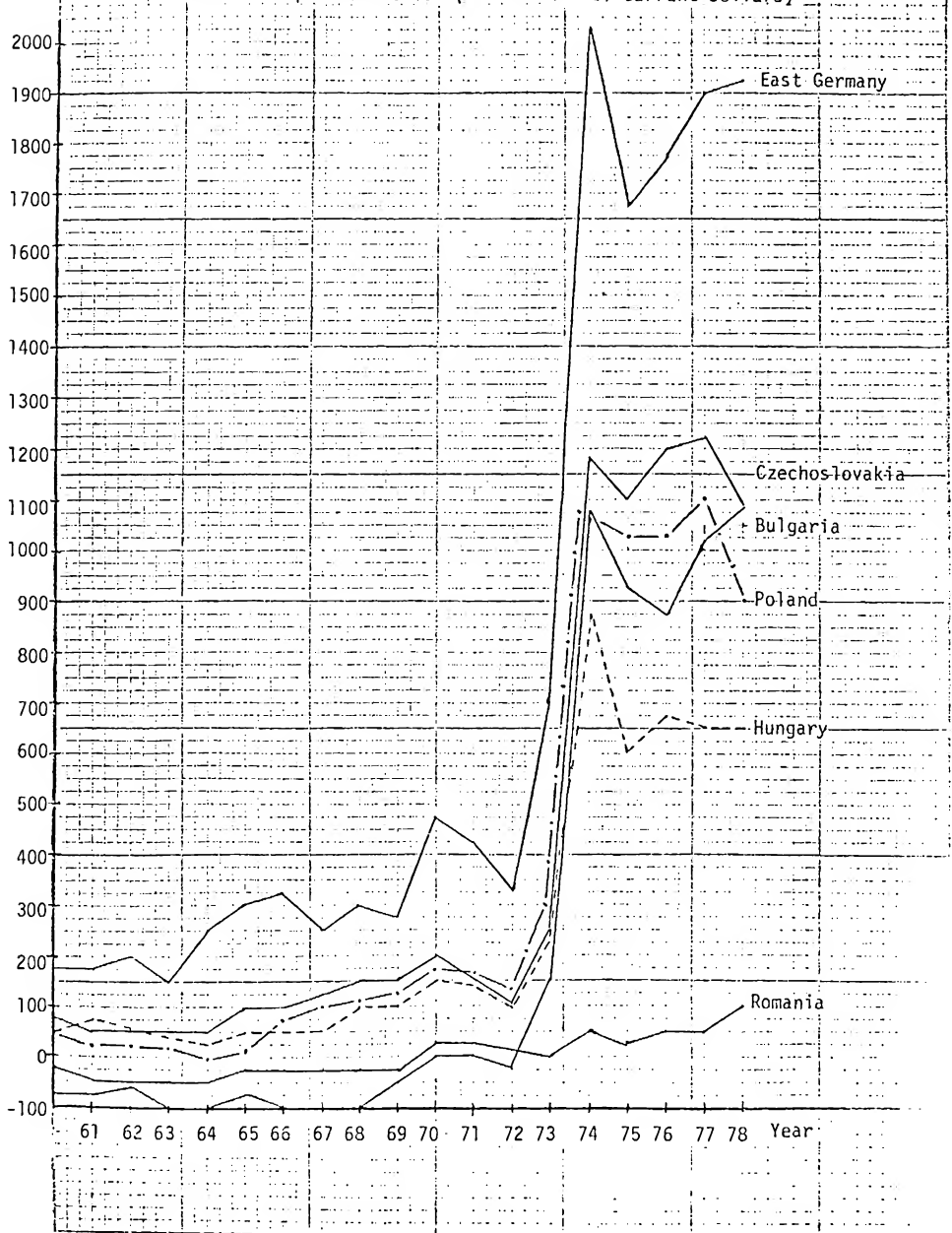
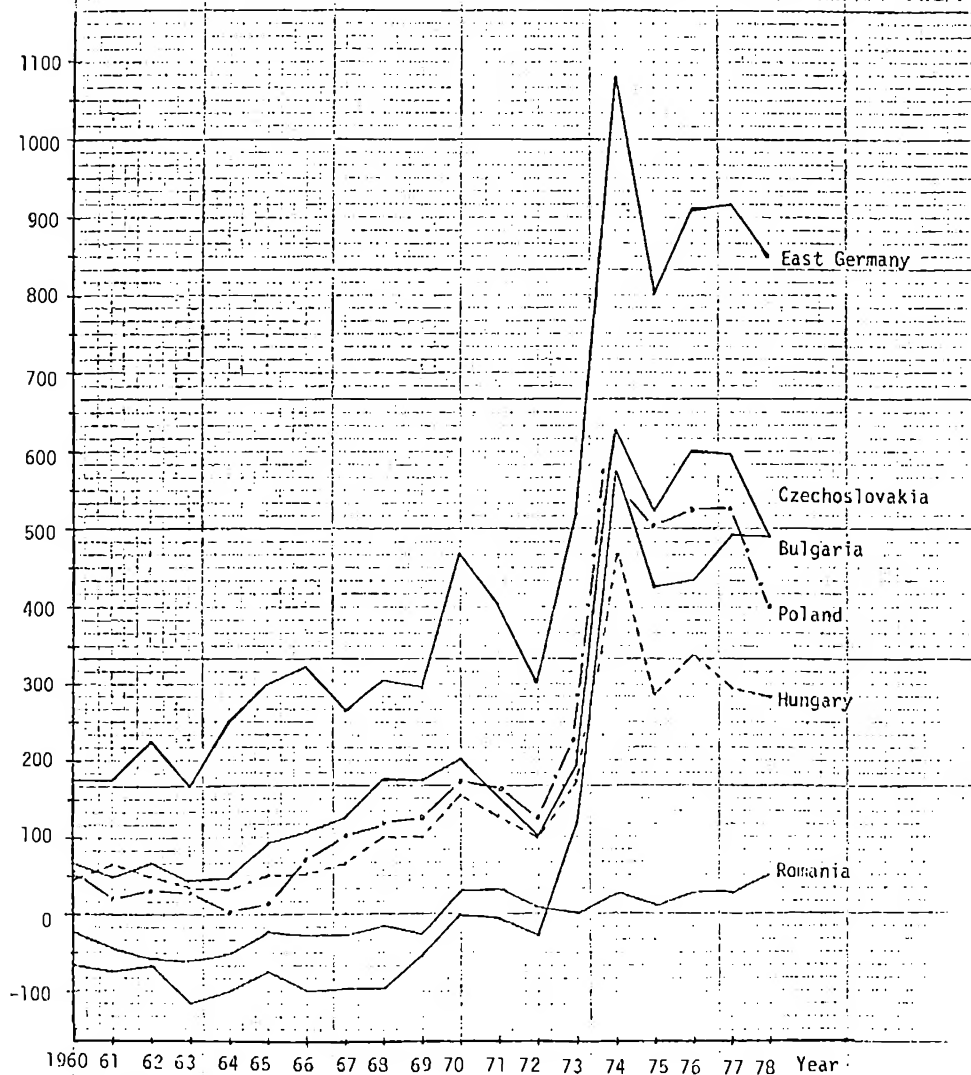


Figure 4. The Trend in Implicit Soviet Trade Subsidies Granted to Individual Eastern European Countries (in Millions of 1970 Dollars)



calculated using the discount rates based on annual averages of 3-month Euro-dollar loan interest rates.⁵

The surprising finding in Table 2 is that in the case of Bulgaria during 1960-69 and 1971-72 and in the case of Romania during 1960-69, the implicit trade subsidies were negative, i.e., Bulgaria and Romania paid implicit trade taxes to the Soviet Union.⁶ Only since 1973 has the Soviet trade treatment of Bulgaria been very similar to that of the rest of Eastern Europe with the exception of Romania. While Romania began to receive implicit Soviet trade subsidies in 1970, the magnitude of these subsidies during 1970-78 was negligible relative to the scale of subsidies granted to Eastern Europe especially during the post-1974 period.

Tables 3 through 8 analyze the distribution of subsidies among individual Eastern European countries. Instead of looking at individual years, in Tables 3 - 8 we concentrate on four subperiods (1960-64, 1965-69, 1970-73, 1974-78) and then on the entire 19-year period under study (1960-78). The first period (1960-64) occurred between the 1958 and 1964-65 intra-CMEA ftp revisions. The second period (1964-69) took place between the 1964-65 price revision and the temporary surge in wmp's of primary commodities in the early 1970's. The third period (1970-73) was a transitional period prior to the explosion of wmp's of fuels and other primary commodities. The last period (1974-78) was characterized by a dramatic increase in wmp's of fuels and other primary commodities relative to wmp's of manufactured commodities.

In Table 3 the ratio of implicit Soviet trade subsidies to individual CMEA countries to total Soviet exports to these countries is presented. The first important finding is that for the CMEA Six as a group this ratio has

Table 3. The Ratio of Implicit Soviet Trade Subsidies to Total Soviet Exports to Individual CMEA Countries (Annual Averages in Percent)

Period	Bulgaria	Czecho-slovakia	East Germany	Hungary	Poland	Romania	CMEA Six
1960-64	-38.2	11.1	22.2	20.2	7.5	-23.5	8.1
1965-69	-19.1	19.5	27.2	18.5	13.9	-5.9	14.0
1970-73	2.1	16.6	27.9	20.7	13.7	5.9	17.7
1974-78	33.9	36.2	40.0	31.6	30.8	6.5	33.8

Table 4. Implicit Soviet Trade Subsidies to Individual CMEA Countries in Constant 1970 Dollars (Period Sums in Millions of Dollars)

1960-64	-438.9	268.8	994.4	243.2	133.3	-239.6	961.1
1965-69	-415.8	673.4	1497.4	375.8	428.7	-114.2	2445.3
1970-73	82.3	641.6	1692.8	567.3	672.5	80.5	3736.9
1974-78	2443.0	2842.2	4563.8	1705.0	2520.5	123.3	14203.0
1960-78	1670.6	4426.0	8748.4	2891.3	3755.0	-145.0	21346.3

Table 5. Country Shares in Implicit Soviet Trade Subsidies Measured in Constant 1970 Dollars (in Percent)

1960-64	-45.7	28.0	103.5	25.3	13.8	-24.9	100.0
1965-69	-17.0	27.5	61.2	15.4	17.5	-4.6	100.0
1970-73	2.2	17.2	45.3	15.2	18.0	2.1	100.0
1974-78	17.2	20.0	32.1	12.0	17.8	0.9	100.0
1960-78	7.8	20.7	41.0	13.6	17.6	-0.7	100.0

Table 6. Per Capita Average Annual Implicit Soviet Trade Subsidies to Individual CMEA Countries (in Constant 1970 Dollars)

1960-64	-10.3	3.8	11.7	4.9	0.8	-2.4	1.9
1965-69	-9.8	11.7	17.6	7.5	2.6	-1.1	4.7
1970-73	2.4	11.2	24.8	14.2	5.2	1.0	9.1
1974-78	57.6	39.7	53.5	34.1	15.5	1.3	27.6
1960-78	10.4	16.3	27.0	15.2	6.1	-0.4	10.9

Table 7. Present Value of Implicit Soviet Trade Subsidies to Individual CMEA Countries in 1980 Dollars (Period Sums in Millions of Dollars)

Period	Bulgaria	Czecho-slovakia	East Germany	Hungary	Poland	Romania	CMEA Six
1960-64	-1408.6	876.1	3198.3	789.5	443.3	-761.1	3137.6
1965-69	-1084.1	1706.9	3892.6	949.6	1063.1	-296.9	6231.3
1970-73	205.6	1398.1	3687.4	1234.8	1468.8	170.1	8164.9
1974-78	6920.1	8035.0	12915.9	4842.9	7138.5	357.1	40209.4
1960-78	4633.0	12016.1	23694.2	7816.8	10113.7	-530.8	57743.2

Table 8. Present Value of Per Capita Average Annual Implicit Soviet Trade Subsidies to Individual CMEA Countries (in 1980 Dollars)

1960-64	-33.2	12.2	37.5	15.8	2.7	-7.5	6.1
1965-69	-25.5	23.8	45.6	19.0	6.5	-2.9	12.1
1970-73	6.1	24.4	54.0	30.9	11.3	2.1	19.8
1974-78	163.0	112.1	151.4	96.9	43.9	3.5	78.1
1960-78	28.7	44.1	73.1	41.1	16.4	1.4	29.5

been steadily increasing, rising from 8 percent in the early 1960's to almost 34 percent during 1974-78. Thus the burden of these subsidies on the Soviet economy has been steadily rising over time. Focusing on the last period (1974-78), this ratio is the highest for East Germany, followed by Czechoslovakia, Bulgaria, Hungary, Poland, and finally Romania.

Absolute amounts of Soviet subsidies in constant 1970 dollars for the four subperiods analyzed are listed in Table 4. Once again focusing on the last period (1974-78), the descending ranking of countries with respect to the absolute size of the subsidies is: East Germany, Czechoslovakia, Poland, Bulgaria, Hungary, and Romania. The ranking for 1960-78 is the same except that Bulgaria and Hungary switch positions.

Individual country shares in total implicit Soviet trade subsidies in constant 1970 dollars appear in Table 5. During 1974-78, East Germany received about 32 percent of total Soviet subsidies to all of Eastern Europe, followed by Czechoslovakia (20 percent), Poland (18 percent), Bulgaria (17 percent), Hungary (12 percent), and Romania (1 percent). The Soviet preferential trade treatment of East Germany is even more dramatic when we look at the entire 1960-78 period; during these years East Germany's share amounted to 41 percent. On the other hand, the Bulgarian share during the entire 1960-78 period is less than 8 percent, owing to large implicit Soviet trade taxes imposed on Bulgaria during 1960-69. The shares of the remaining countries during the entire period are very similar to those during the 1974-78 subperiod.

One drawback of Tables 3, 4, and 5 is that these tables do not take into account the size of individual CMEA countries. Employing the 1970

population of each country as a proxy for size,⁷ in Table 6 we present the estimates of per capita average annual implicit Soviet trade subsidies to individual CMEA countries in 1970 dollars. During 1974-78, the annual average per capita subsidies turn out to be the highest for Bulgaria (58 dollars per person per year), followed by East Germany (54 dollars), Czechoslovakia (40 dollars), Hungary (34 dollars), Poland (15 dollars), and Romania (1 dollar). The dramatic rise in Soviet subsidies over time is especially apparent from the data in the last column of Table 6. While during 1960-64 the subsidies amounted to about 2 dollars a year per person in Eastern Europe, during 1965-69 this amount increased to almost 5 dollars, it reached 9 dollars during 1970-73, and then tripled again, reaching almost 28 dollars per person a year during 1974-78.

Table 7 presents information on the present value of implicit Soviet trade subsidies to individual CMEA countries in 1980 dollars. The advantage of forward discounting of subsidies is that we are able to say how much resources in terms of 1980 dollars, inclusive of compound interest, the Soviet Union transferred to individual Eastern European countries. The present value of implicit Soviet trade subsidies to the CMEA Six during 1960-78 is about 57.7 billion dollars, of which 23.7 billion dollars was granted to East Germany, 12.0 billion dollars to Czechoslovakia, 10.1 billion dollars to Poland, 7.8 billion dollars to Hungary, and 4.6 billion dollars to Bulgaria. In the case of Romania, the implicit trade taxes charged by the Soviet Union, amounting close to 1.0 billion dollars during 1960-69, more than offset the implicit subsidies of about 0.5 billion during 1970-78; consequently, over the entire period 1960-78 the Soviet Union imposed net implicit trade taxes on Romania amounting to about 0.5 billion dollars.

The last table presented above, Table 8, contains information on the present value of per capita average annual implicit subsidies in 1980 dollars and it serves to supplement the information already presented in Tables 6 and 7,

What are the conclusions that emerge from Tables 3 through 8? First of all, it is clear from Table 2 that in absolute terms the Soviet Union has always subsidized East Germany to a greater degree than any other CMEA economy. The next most subsidized country has been Czechoslovakia, followed by Poland, Hungary, Bulgaria, and Romania. However, it is impossible to consider the Bulgarian case as stable during 1960-78. For instance, since 1974 Bulgaria received greater implicit trade subsidies than Hungary--a stunning contrast to the pre-1974 situation. Given the dramatic growth of implicit subsidies granted to Bulgaria, it is quite possible that by 1979 Bulgaria may have even surpassed Poland and moved very close to Czechoslovakia.

On the other hand, as far as the amount of implicit subsidies in relative terms (with respect to the size of the country approximated by her 1970 population) is concerned, the ranking of countries that emerges is somewhat different from the one given above. During 1960-78 East Germany and Czechoslovakia still appear to have been the most subsidized economies even in relative terms, but Hungary and Bulgaria appear to have received considerably more in relative terms than Poland, which is by far the largest Eastern European country in terms of population. Romania, just as before, ranks as the least subsidized country. The most important development that took place during 1974-78 is the spectacular increase in relative subsidies granted to Bulgaria; as a result of the growth in these subsidies, during the latter half of the 1970's Bulgaria appears to be the most subsidized Eastern European economy in relative terms, surpassing even East Germany.

Section III: Unconventional Gains from Trade

Unconventional gains from trade are defined as the non-market benefits of bilateral agreements which are secured through bilateral preferential trade treatment. Non-market benefits of bilateral agreements may be categorized into four classes: military, political, economic, and ideological.⁸

Before we enumerate the non-market benefits available to the Soviet Union, some comments concerning Romania are appropriate. As is evident from section II, implicit Soviet taxes and subsidies to Romania are relatively minor. We attribute this outcome to Romania's unwillingness to supply non-market benefits to the Soviet Union. For instance, Soviet troops left Romania in June 1958, when a status-of-force agreement (concluded a little more than a year earlier) lapsed.⁹ Since that time, no Soviet troops have been stationed in Romania. Moreover, Romanian troop contingents have ceased participating in joint Warsaw Pact (WP) military exercises since 1967. In fact, Romanian defense strategy is not only independent of the strategy of other WP members, but may be designed specifically to discourage a WP invasion of Romania.¹⁰ Other signs of foreign policy independence include Romania's refusal to denounce Israel after the Six-Day War and Romania's condemnation of the 1968 WP intervention in Czechoslovakia (in which no Romanian troops were involved). On the commercial front, Romania has redirected her trade toward the West since the 1950's, even more intensively after Ceausescu's rise to power in March 1965.¹¹

Because unconventional gains from trade do not characterize Soviet trade relations with Romania, little further discussion of Romania appears in

in the rest of the paper, even though some tables may include data on Romania for the sake of completeness. However, the Soviet-Romanian trade pattern does seem to offer one lesson. In spite of utilizing distorted CMEA prices, the Soviet Union and Romania have been able to conduct trade over a relatively long period of time, for which the extent of implicit taxation (negative subsidies) and subsidization has been insignificant. Thus Soviet-Romanian trade, just like trade between any two CMEA Six countries, demonstrates that implicit subsidies and taxes are not necessary offshoots of intra-CMEA trade. The lesson is straightforward: because the relative distortion of export and import prices for any particular commodity category, with the exception of fuels, are approximately equal, bilateral balancing of each commodity category results in an overall absence of implicit trade subsidies.

Now let us focus our attention on the non-market benefits received by the Soviet Union. Tables 9 and 10 contain some indication of the non-market benefits obtainable from CMEA Six. Bulgaria is on the low end of the spectrum with respect to land area, population, and stationing of Soviet troops. However,

Table 9: Relatively Stable Characteristics, CMEA Six during 1960-1978

<u>Country Code</u>	<u>Land Area (Sq. miles)</u>	<u>% of CMEA6 Population,</u> <u>1960 1978</u>		<u># of Soviet Divisions Stationed,*</u> <u>1960-68 1969-78</u>		<u>Instances of Domestic Political Instability</u>
B	42,823	8.0	8.2	0	0	1968
C	49,373	14.2	14.0	0	5	
GDR	41,768	17.1	15.3	20	20	
H	35,919	10.5	9.8	4	4	1970, 1976
P	117,655	31.0	32.4	2	2	
R	91,699	19.2	20.3	0	0	

* Source: The Military Balance, annual.

Table 10: Length of CMEA Six Borders, in miles*

<u>Country Code</u>	<u>Warsaw Pact Countries</u>	<u>NATO Countries</u>	<u>Austria or Yugoslavia</u>	<u>Baltic or Black Sea</u>
B	290	458	335	248
C	1,617	237	354	-
GDR	552	856	-	200
H	758	-	609	-
P	1,972	-	-	300
R	1,760	-	350	-

* Source: Area Handbooks of CMEA Six countries.

Bulgaria ranks high with respect to borders with NATO countries (even though Greece and Turkey are not as strategically important as West Germany) and domestic political stability. Also, Bulgaria's population has been supportive of Soviet-Bulgarian relations, which has enhanced the political allegiance Bulgaria has shown toward the Soviet Union.

Czechoslovakia is at the lower end of the spectrum with respect to land area, in the middle with population and stationing of Soviet troops, and at the higher end due to borders with West Germany and Austria. However, the Warsaw Pact's 1968 intervention in Czechoslovakia was costly to the Soviet Union, as has been the relative coolness of the Czechoslovak population toward Soviet-Czechoslovak relations. So while the Czechoslovak government has demonstrated strong allegiance to the Soviet Union since 1968, the potential for widespread domestic instability has remained high.

The GDR is on the lower end of the spectrum with respect to land area and in the middle with population. Otherwise, the GDR is the most strategically important CMEA Six country to the Soviet Union, with 20 Soviet divisions stationed there and an 856 mile border with West Germany, and has experienced no incidents of domestic political instability which seriously threatened the interests of the Soviet Union.

Hungary features the smallest land area of CMEA Six countries, second smallest population and no borders with NATO countries. Aspects more beneficial to the Soviet Union include the 4 Soviet divisions stationed in Hungary,

the absence of domestic political instability, and lengthy borders with Austria and Yugoslavia. Finally, the Hungarian population has been relatively indifferent to Soviet-Hungarian relations.

Poland has the largest land area and population of CMEA Six countries. Moreover, 2 Soviet divisions are stationed in Poland and Poland has a 300 mile border on the Baltic Sea. However, the domestic labor unrest in 1970 and 1976 (as well as the strikes of 1980), the size of the private sector in agriculture, the influence of the Roman Catholic Church, the population's deep mistrust of the Soviet Union, and Poland's extensive relations with the West have combined to create an atmosphere of weak political allegiance to the Soviet Union.

Romania, also noted for substantial land area and a large population, ranks as the least friendly CMEA Six country to the Soviet Union with respect to military cooperation, political allegiance and ideological agreement.

On the issue of strategic importance, most authorities agree that the Northern Tier of Eastern Europe (GDR, Czechoslovakia, Poland) is much more strategically important to the Soviet Union than the Southern Tier. Distribution of Soviet troops stationed in Eastern Europe and the relative strengths of CMEA Six air forces suggest that the Soviet Union also recognizes the greater strategic value of the Northern Tier.¹²

Other major factors which influence the non-market benefits that the Soviet Union receives from the CMEA Six include historic friendships and animosities, ethnic considerations, political support for Soviet foreign policy in international forums, active assistance in the propagation of

Soviet political ideology to other countries, and the loyalty (to the Soviet Union), quality and composition of each country's armed forces.¹³ Rather than including an analysis of these factors here, we note that they tend to convey a picture very similar to that portrayed by the above remarks. Namely, the ranking in descending order of CMEA Six countries, which have provided the Soviet Union with the most non-market benefits, is: 1. GDR; 2. Czechoslovakia; 3. Bulgaria; 4. Hungary; 5. Poland; 6. Romania.

Why should allegiance and other forms of non-market benefits be secured via a trade-related subsidy rather than a direct grant? Two abstract examples serve to illustrate that unconventional gains from trade arise because of conflicts among different groups in society, which motivate government officials to choose bilateral preferential trade treatment as a hidden way of generating non-market benefits.

Consider three countries: POLECON, representing a politicized economy interested in obtaining non-market benefits from EXECON; EXECON, which is a potential external source of non-market benefits for either POLECON or ROW; ROW, the rest of the world, which is also interested in obtaining non-market benefits from EXECON.

In the first example, EXECON's non-market benefits are auctioned to the highest bidder. Suppose POLECON is the highest bidder. Why doesn't POLECON send a lump-sum payment to EXECON for these non-market benefits?

Assume that a conflict exists within POLECON. Suppose POLECON's government values highly the non-market benefits from EXECON but POLECON's population does not. POLECON's government may decide to use a hidden means to purchase the non-market benefits in order to circumvent domestic conflict.

Why might POLECON decide to alter her bilateral terms of trade with EXECON? Anyone not closely associated with POLECON's government would have difficulty in determining world market prices because of the proliferation of grades and qualities of commodities and because of the paucity of detailed trade data. So POLECON could covertly pay for non-market benefits by exporting goods to EXECON at discount prices and importing goods from EXECON at premium prices. Moreover, as long as POLECON either knows, or is able to predict reasonably well, the world market prices of those commodities to which discounts or premiums are to be added, POLECON will be able to calculate the "implicit subsidy" that EXECON is receiving.

In the second example, hegemony, defined as a situation in which one country has power superior to that of other countries, plays a crucial role. Assume POLECON has hegemony over EXECON. In the bilateral bargaining situation between POLECON and EXECON over non-market benefits, hegemony confers on POLECON three powers: (1) elimination of ROW as an alternative purchaser of non-market benefits; (2) control over the quantity of non-market benefits received; (3) some control over the amount paid to EXECON for the non-market benefits.

The first element of hegemony restricts EXECON from auctioning her non-market benefits to the highest bidder. The second allows POLECON to choose q^* , the quantity of non-market benefits to be transferred. The third refers to the set of feasible payments for q^* .

Assume POLECON will not pay more than the amount

$v_p(q^*)$ to EXECON for q^* , and EXECON will not accept less than the amount $v_E(q^*)$ from POLECON for q^* . So the bilateral bargaining problem is to choose $a(q^*)$, the actual payment for q^* , such that $v_E(q^*) \leq a(q^*) \leq v_p(q^*)$. POLECON may not have power to set $a(q^*) = v_E(q^*)$, possibly because EXECON will argue that POLECON already has imposed restrictions on EXECON by eliminating the auction process and by choosing q^* . However, POLECON's control over price can be quantified, at least conceptually, by an index of price control $\phi(q^*)$, which is calculated as:

$$\phi(q^*) = 1 - \frac{a(q^*) - v_E(q^*)}{v_p(q^*) - v_E(q^*)} \quad \dots(7)$$

If $\phi(q^*) = 0$, then POLECON has no price control; if $\phi(q^*) = 1$, then POLECON has complete price control.

In the case in which the transfer of non-market benefits from EXECON to POLECON is advantageous or at least non-detrimental to all parties in both countries, then the solution to the bilateral bargaining problem may well be a zero payment to EXECON because EXECON does not have a viable threat position [this is certainly so if $\phi(q^*) = 1$]. However the following assumptions provide a framework in which implicit trade subsidies are likely to be present: (a) POLECON realizes that EXECON's population, as distinct from EXECON's government, interprets greater military and political association with POLECON as meaning less sovereignty; (b) sovereignty is a commodity desired by EXECON's population; (c) POLECON's government is willing to subsidize EXECON in an effort to partially offset the negative utility associated with loss of sovereignty; (d) POLECON's government does not want POLECON's population to realize that the

non-market benefits obtained from EXECON are being purchased. Thus, even if the governments of POLECON and EXECON have the same preferences, as long as EXECON's population can threaten POLECON's government with the possibility of social instability, payment via implicit trade subsidies is a plausible policy tool.

Contrasting these examples to Eastern European reality, we believe that the second example more closely approximates the relationship between the Soviet Union and the CMEA Four, while neither example mirrors the Soviet-Romanian situation. The Bulgarian-Soviet relationship is generally considered to be very friendly, consequently it is unclear why Soviet subsidies to Bulgaria increased so dramatically beginning in 1973.

One topic which is of great importance to our discussion of unconventional gains from trade is the welfare position of each CMEA Six country. Our discussion is from the Soviet point of view, and we claim that the Soviet Union is better off by paying for non-market benefits than by not paying and risking the loss of Eastern European allegiance. However we are not arguing that each CMEA Six country is better off. In fact, in Marrese and Vanous [1980a] we argue that certain CMEA Six countries would be better off if military, political and ideological association with the Soviet Union could be reduced bloodlessly to levels determined by these CMEA Six countries.

Section IV: The Econometric Analysis

As mentioned in the previous section, Romania and the Soviet Union did not engage in close bilateral association during most of the period 1960-78. So Romania will not be included in the econometric analysis. Bulgaria has been eliminated from this presentation of the econometric results because the reasons for implicit taxes imposed on Bulgaria during the 1960's have eluded the authors thus far. Consequently an econometric analysis of implicit Soviet trade subsidies to the CMEA Four appears in this section.

The econometric analysis consists of two parts. In part 1, the real value of the aggregate implicit Soviet trade subsidy to Czechoslovakia, the GDR, Hungary and Poland (RSCMEA4) is the dependent variable in a log-linear specification which takes into account a time trend, short-run economic tension within the Soviet Union, and the institutional rigidity of the CMEA pricing formula. In part 2, the individual country components of RSCMEA4, namely country-specific subsidies to Czechoslovakia, the GDR, Hungary and Poland, are the dependent variables in a non-linear maximum likelihood full information specification designed to distribute the predicted values and the residuals from part 1.

(8) is the equation estimated in part 1:

$$\ln(RSCMEA4_t) = \ln\alpha_0 + \alpha_1 t + \alpha_2 UGMOXDW_t + \alpha_3 \ln(RIGID_t) + u_t$$

...(8)

where RSCMEA4 implicit Soviet subsidies to the CMEA Four in constant 1970 dollars; values may be obtained from Table 2

t time; t = 0 in 1960, ..., t = 18 in 1978

UGMOXDW the ratio of Soviet grain imports from the Developed West to Soviet exports to the Developed West; values found in Appendix 1

RIGID the ratio of Soviet terms of trade calculated at world market prices to Soviet terms of trade calculated at prices generated by the CMEA formula pricing rule; values found in Appendix 1; for 1960, RIGID is normalized to equal 1.00.

u normally distributed error term with mean zero.

RSCMEA4 reflects a combination of the value that the Soviet Union places on the military, political, economic and ideological non-market benefits obtained from the CMEA Four and the bargaining power of the CMEA Four. $\hat{\alpha}_0$ is an estimate of the benchmark (1960) value of RSCMEA4, corrected for any influence which the other independent variables may have had in 1960. Because $t = 0$, $UGMOXDW = .001$ and $\ln(RIGID) = 0$ in 1960, $\hat{\alpha}_0 = 337.72$ (see Table 11) which is very close to the value of RSCMEA4 in 1960, 342.1.

The inclusion of time allows for changes both in the value that the Soviet Union places on the non-market benefits obtained from the CMEA Four and in CMEA Four's bargaining position. $\hat{\alpha}_1 = 0.099$ (see Table 11) indicates that the net effect of these two considerations was a 9.9% annual increase in subsidies to the CMEA Four during 1960-78. Moreover, the high statistical significance of both the constant term and the exponential time trend provide evidence that the Soviet Union is paying substantially more in real terms to the CMEA Four for a relatively constant quantity of non-market benefits (see section III), even when Soviet harvest failures and CMEA institutional price rigidity are taken into account. This result is related to a wide variety of factors such as Eastern Europe's completed post-war reconstruction, détente with the West, and increases in the consumer expectations and political restlessness of CMEA Four populations.

UGMOXDW, the ratio of Soviet grain imports from the Developed West to

Soviet exports to the Developed West, represents short-run economic tension within the Soviet Union under the assumption that the major cause of domestic tension is harvest failure. From Table 11, UGMOXDW is significant and exhibits the correct sign. This supports the a priori notion that Soviet subsidies are also dependent on domestic stability within the Soviet Union.

RIGID, the ratio of Soviet terms of trade calculated at world market prices (wmp's) to Soviet terms of trade calculated at prices generated by the CMEA formula pricing rule, captures the amount of subsidy that can be explained by the institutional rigidity of the CMEA pricing formula, under the assumption that intra-CMEA foreign trade prices are set according to the CMEA pricing formula. While reference is often made to a CMEA pricing formula based on lagged wmp's, researchers studying the CMEA do not always agree as to its exact form. We have adopted the following CMEA pricing formula¹⁴:

<u>Period</u>	<u>CMEA formula prices</u>
1960-64	average 1957-58 wmp's
1965	$1/2(\text{ave. 1957-58 wmp's}) + 1/2(\text{ave. 1960-64 wmp's})$
1966-74	average 1960-64 wmp's
1975	average 1972-74 wmp's
1976	average 1972-75 wmp's
1977	average 1972-76 wmp's
1978	average 1973-77 wmp's

RIGID (see Table 11) is highly significant and exhibits the correct sign. So CMEA institutional price rigidity seems to contribute to the presence of implicit Soviet trade subsidies. The Soviet Union's attitude toward this by-product of the CMEA pricing formula probably has been changing over time, and these changes and their implications for reform of intra-CMEA trading practices will be discussed by the authors in a future paper.

(9) describes the simultaneous system of non-linear equations estimated by full information maximum likelihood in part 2:

$$\left. \begin{aligned} RSC_t &= \beta_{oC} + \beta_{1C} PRSCMEA4_t + \beta_{2C} RESID_t \\ RSG_t &= \beta_{oG} + \beta_{1G} PRSCMEA4_t + \beta_{2G} RESID_t \\ RSH_t &= \beta_{oH} + \beta_{1H} PRSCMEA4_t + \beta_{2H} RESID_t \\ RSP_t &= -\beta_{oC} - \beta_{oG} - \beta_{oH} + (1 - \beta_{1C} - \beta_{1G} - \beta_{1H}) PRSCMEA4_t \\ &\quad + (1 - \beta_{2C} - \beta_{2G} - \beta_{2H}) RESID_t \end{aligned} \right\} \quad (9)$$

where RSC, RSG, RSH and RSP { implicit Soviet subsidies to
Czechoslovakia, the GDR, Hungary and
Poland respectively; values in 1970
dollars appear in Table 2.

PRSCMEA4 the predicted value of RSCMEA4 from part 1

RESID the residual from part 1

By construction, $RSCMEA4 = RSC + RSG + RSH + RSP$. Also (9) embodies three cross-section constraints: the shift parameters sum to zero and the two sets of distribution parameters sum to one.

Tables 12-15 contain the econometric results. These results confirm the analysis of section 2, namely that East Germany is the most heavily subsidized country, followed by Czechoslovakia, Poland and Hungary. Perhaps the most

Table 11: Results of the Ordinary Least Squares Estimation in Part 1

LEFT-HAND VARIABLE: $\ln(RSCHEA4)$

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC	2-TAILED T-PROBABILITY
Constant	5.82222	0.653892E-01	89.0395	0.0000
T	0.990984E-01	0.758087E-02	13.0722	0.0000
UG40XDW	-0.523500	0.221970	- 2.35842	0.0323
$\ln(RIGID)$	2.33364	0.316697	7.36868	0.0000

R-SQUARED = 0.9787

DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) = 1.7943

NUMBER OF OBSERVATIONS = 19.

SUM OF SQUARED RESIDUALS = 0.224929

STANDARD ERROR OF REGRESSION = 0.12245

SUM OF RESIDUALS = 0.161171E-03

MEAN OF DEPENDENT VARIABLE = 6.66568

EQUATION F-STATISTIC(4., 15.) = 42395.4 PROB. = 0.0000

SLOPES F-STATISTIC (3., 15.) = 229.903 PROB. = 0.0000

Table 12: FIML Estimates for Implicit Soviet Trade Subsidies to Czechoslovakia

DEPENDENT VARIABLE: RSC

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	PSEUDO T- STATISTIC ¹⁵	2-TAILED T- PROBABILITY
Constant	- 33.9597	7.87840	- 4.31047	0.0004
PRSCMEA4	0.254166	0.597493E-02	42.5387	0.0000
RESID	0.372949	0.367269E-01	10.1546	0.0000

R-SQUARED = 0.9905

DURBIN-WATSON STATISTIC (ADJ. FOR O. GAPS)¹⁶ = 1.8255

NUMBER OF OBSERVATIONS = 19.

SUM OF SQUARED RESIDUALS = 7792.01

STANDARD ERROR OF THE REGRESSION = 20.2511

SUM OF RESIDUALS = 26.9571

MEAN OF DEPENDENT VARIABLE = 232.939

Table 13: FIML Estimates for Implicit Soviet Trade Subsidies to the GDR

<u>DEPENDENT VARIABLE:</u> RSG				
RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	PSEUDO T-STATISTIC	2-TAILED T-PROBABILITY
Constant	90.3150	11.6607	7.74525	0.0000
PRSCHEA4	0.355868	0.884337E-02	40.2411	0.0000
RESID	0.305918	0.543590E-01	5.62773	0.0000

R-SQUARED = 0.9896

DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) = 1.4602

NUMBER OF OBSERVATIONS = 19.

SUM OF SQUARED RESIDUALS = 16376.8

STANDARD ERROR OF THE REGRESSION = 29.3587

SUM OF RESIDUALS = -17.8758

MEAN OF DEPENDENT VARIABLE = 460.443

Table 14: FIHL Estimates for Implicit Soviet Trade Subsidies to Hungary

DEPENDENT VARIABLE: RSH

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	PSEUDO T- STATISTIC	2-TAILED T- PROBABILITY
Constant	-4.42432	5.48454	- 0.806688	0.4276
PRSCNEA4	0.153019	0.415942E-02	36.7887	0.0000
RESID	0.343180E-01	0.255675E-01	1.34225	0.1940

R-SQUARED = 0.9834

DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) = 2.0483

NUMBER OF OBSERVATIONS = 19.

SUM OF SQUARED RESIDUALS = 4991.02

STANDARD ERROR OF THE REGRESSION = 16.2076

SUM OF RESIDUALS = -50.7376

MEAN OF DEPENDENT VARIABLE = 152.174

Table 15: FIML Estimates for Implicit Soviet Trade Subsidies to Poland

DEPENDENT VARIABLE: RSP

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	PSEUDO T- STATISTIC	2-TAILED T- PROBABILITY
CONSTANT	-57.8037	8.62081	-6.00915	0.0000
PRSCNEA4	0.237233	0.653793E-02	36.2856	0.0000
RESID	0.284273	0.401882E-01	7.07353	0.0000

R-SQUARED = 0.9864

DURBIN-WATSON STATISTIC (ADJ.FOR 0. GAPS) = 1.9548

NUMBER OF OBSERVATIONS = 19.

SUM OF SQUARED RESIDUALS = 9838.93

STANDARD ERROR OF THE REGRESSION = 22.7561

SUM OF RESIDUALS = 42.6936

MEAN OF DEPENDENT VARIABLES = 197.630

startling finding is the stability of both sets of distribution parameters over time. All distribution parameters are significant, except for Hungary's share of the unexplained residual from part 1.

The question of the extent to which implicit Soviet trade subsidies occurred because of CMEA institutional price rigidity or because of a conscious Soviet decision to subsidize, can be answered fully only by examining at the commodity category level of aggregation: each country's CMEA export-import mix, each country's non-CMEA export-import mix, evidence of price discrimination within CMEA, and differences between relative wmp's and relative intra-CMEA ftp's. Nonetheless, the above-mentioned econometric specification does allow us to decompose the subsidy time series in a manner which yields some tentative answers to this question.

Consider the following four hypothetical time series based on the specification described in equation (8) and the parameter values found in Table 11:

$$\text{NOGROW}_t = \ln(5.8222) - 0.5235\text{UGMOXDW}_t + 2.3364 \ln(\text{RIGID}_t) + \text{residual}_t$$

$$\text{GOODAG}_t = \ln(5.8222) + 0.0990984t + 2.3364 \ln(\text{RIGID}_t) + \text{residual}_t$$

$$\text{FLEX}_t = \ln(5.82222) + 0.0990984t - 0.5235\text{UGMOXDW}_t + \text{residual}_t$$

$$\text{BOTH}_t = \ln(5.8222) + 0.099084t + \text{residual}_t$$

where residual_t is the residual from equation (8).

NOGROW, GOODAG, FLEX, and BOTH respectively represent the hypothetical real values of the aggregate implicit Soviet trade subsidy to the CMEA Four under four assumptions: (a) zero trend growth in the subsidies since 1960; (b) no Soviet harvest failures since 1960, implying zero Soviet imports of grain

from the Developed West; (c) since 1960, Soviet terms of trade calculated at wmp's have equaled Soviet terms of trade calculated at prices generated by the CMEA formula pricing rule, thus $RIGID_t = 1.0$ for all t ; (d) both (b) and (c) have held since 1960. Setting $RIGID_t = 1.0$ for all t purges distortions in the overall terms of trade from the RSCMEA4 timeseries, but still "permits" subsidies to have occurred because of bilateral imbalances within commodity categories.

The first four columns of Table 16 contain the values of these four hypothetical variables, while the next four columns contain the ratio of these four hypothetical variables over the actual real value of the implicit trade subsidy to the CMEA Four, RSCMEA4.

As expected, columns 1 and 5 of Table 16, which refer to NOGROW, indicate that the 9.9% increase in RSCMEA4 is the dominant explanatory force behind the real growth in implicit subsidies. NOGROW generally remained within ± 25 per cent of its 1960 value, and at no time during 1960-78 did NOGROW much more than double its 1960 value. Column 6 points out that the absence of harvest failures would have reduced real implicit trade subsidies by more than 10 per cent in 8 out of the 19 years under investigation. Columns 3 and 7 demonstrate that CMEA institutional price flexibility, as incorporated by $RIDIG_t = 1.0$, generally would have increased subsidies until 1973, after which the impact became negative. During 1974-77, this negative impact was quite substantial. Finally, columns 4 and 8 show that the absence of both the harvest failure effect and the CMEA institutional price rigidity effect generally would have resulted in greater subsidization, except for 1974-77.

Two results from Tables 12-16 suggest tentative support for the notion that implicit trade subsidies occurred because of conscious Soviet decisions.

Table 16: Decomposing the Real Value of the Aggregate Implicit Soviet Trade Subsidy to Czechoslovakia, the GDR, Hungary and Poland

Year	NOGROW	GOODAG	FLEX	BOTH	NOGROW	GOODAG	FLEX	BOTH
					RSCNEA4	RSCNEA4	RSCNEA4	RSCNEA4
1960	342.0	342.2	342.0	342.2	1.000	1.000	1.000	1.000
1961	279.9	319.1	324.1	329.9	0.893	1.018	1.034	1.052
1962	316.2	381.1	432.5	432.8	0.830	1.001	1.136	1.136
1963	200.8	303.3	396.2	430.5	0.721	1.089	1.422	1.545
1964	215.0	408.9	390.9	492.1	0.663	1.260	1.205	1.517
1965	299.4	522.7	528.9	594.4	0.643	1.122	1.136	1.276
1966	345.0	621.1	623.1	695.3	0.619	1.114	1.117	1.247
1967	287.2	583.2	662.8	690.5	0.513	1.042	1.184	1.233
1968	360.4	721.2	801.7	824.8	0.514	1.028	1.143	1.176
1969	272.3	698.2	797.1	805.6	0.394	1.011	1.154	1.167
1970	422.9	1021.5	970.1	993.6	0.424	1.024	0.973	0.996
1971	222.6	883.4	874.2	910.4	0.262	1.041	1.031	1.073
1972	44.4	798.9	708.7	899.2	0.071	1.276	1.132	1.436
1973	300.2	1368.0	983.0	1219.5	0.272	1.241	0.891	1.106
1974	435.2	2914.8	948.2	1017.4	0.158	1.060	0.345	0.370
1975	672.7	2470.6	1502.5	1746.2	0.319	1.171	0.712	0.828
1976	706.4	2783.1	1661.3	1922.8	0.296	1.167	0.697	0.806
1977	380.8	2565.1	1605.6	1752.1	0.162	1.090	0.682	0.744
1978	351.4	2305.3	1784.2	2021.7	0.173	1.133	0.877	0.994

First, CMEA institutional price rigidity did not have a substantial negative impact until 1973. In 1974, this hypothetical impact would have been a 65.5 per cent reduction in RSCMEA4, then would have led to per cent reductions of 28.8, 30.3, 31.8 and 12.3 in 1975-78 respectively. Because setting $RIGID_t = 1.0$ for all t implies that subsidies could have occurred only due to bilateral imbalances within commodity categories, we feel that the lessening of the negative impact of perfect price flexibility after 1974 is evidence of a conscious Soviet desire to subsidize the CMEA Four. Second, looking at Tables 12-15, we interpret the relative magnitudes and the high statistical significance of both sets of distribution parameters as conforming to the notion that the Soviet Union is responding to the relative amounts of non-market benefits available.

Section V: Other Explanations for the Presence of Implicit Soviet Trade Subsidies

Two explanations, other than the desire to obtain unconventional gains from trade, could be posited for the presence of implicit Soviet trade subsidies to Eastern Europe. One possibility is that CMEA institutional price rigidity along with a more general type of institutional rigidity are responsible for the subsidies. However, this explanation does not imply that the Soviet Union is unconsciously providing subsidies. If the Soviet Union did not wish to subsidize Eastern Europe, then we are puzzled as to why more institutional change hasn't occurred during 1960-78. Earlier, we have argued that the Soviet Union did wish to subsidize Eastern Europe in order to obtain unconventional gains from trade, and therefore may have found it preferable (for a time) to accept institutional rigidities. In other words, the Soviet Union may have believed that any institutional change that would reduce implicit trade subsidies, would also increase the risk of social instability in Eastern Europe. So the existence of institutional rigidities may be due to the Soviet Union's preference for social stability.

Another possibility is altruism. Economists in general are skeptical of this explanation in most situations, and we tend to doubt its validity in this situation.

Appendix 1: Data

	UGMOXDW	RIGID
1960	.001	1.0000
1961	.03	0.9876
1962	.001	0.9442
1963	.15	0.8688
1964	.43	0.9253
1965	.24	0.9424
1966	.24	0.9461
1967	.08	0.9286
1968	.06	0.9379
1969	.02	0.9418
1970	.05	1.0131
1971	.07	0.9884
1972	.36	0.9602
1973	.41	1.0502
1974	.10	1.4561
1975	.34	1.1848
1976	.33	1.1971
1977	.16	1.1715
1978	.24	1.0582

FOOTNOTES

¹E.g., Hewett [1974]. p.90, estimates that relative to 1960 Soviet terms of trade with Eastern Europe declined 11 to 21 percent during 1965-70...Official Soviet estimates also reported in Hewett put the decline into the range of 10 to 19 percent.

²According to the rather vague CMEA rules for price formation in effect until the end of 1974, intra-CMEA ftp's were based on lagged averages of wmp's, periodically (every five years) revised and purged of various negative influences of the world capitalist market, such as monopoly influences, temporary speculative trends, short-term and cyclical influences, etc. In 1975 intra-CMEA ftp's were supposed to be based on the lagged average of wmp's during the period 1972-74; in 1976 the base period was supposed to cover years 1972-75; from 1977 on intra-CMEA ftp's are supposedly constructed on the basis of the lagged five-year moving average of wmp's.

³Cumulative Soviet imports of machinery and equipment from the Developed West and the cumulative Soviet trade deficit with the Developed West were calculated on the basis of the data in Vanous [1980a], Tables 60 and 150.

⁴The overall Soviet import price index from the Developed West was constructed by Vanous as a part of his [1980b] study for the W.E.F.A. SEEMOD Project. The values of the index are as follows:

1960 = 101	1965 = 99	1970 = 100	1975 = 208
1961 = 96	1966 = 100	1971 = 105	1976 = 196
1962 = 93	1967 = 97	1972 = 109	1977 = 207
1963 = 95	1968 = 94	1973 = 133	1978 = 224
1964 = 99	1969 = 96	1974 = 187	

⁵In particular, we relied on quotations of 3-month Eurodollar interest rates (annual averages) published in various issues of Euromoney and in Paul Einzig, The Eurodollar System (London:Macmillan, 1970, 4th Edition). The actual discount table looked as follows:

1960 = 3.5976	1965 = 2.9616	1970 = 2.1575	1975 = 1.4586
1961 = 3.4536	1966 = 2.8227	1971 = 1.9881	1976 = 1.3629
1962 = 3.3342	1967 = 2.6562	1972 = 1.8653	1977 = 1.2909
1963 = 3.2134	1968 = 2.5186	1973 = 1.7688	1978 = 1.2175
1964 = 3.0922	1969 = 2.3680	1974 = 1.6192	1979 = 1.1196
			1980 = 1.0000

⁶In addition, this also appears to be the case of Poland in 1964, but the amount of implicit taxes (2 million dollars) is not significant.

⁷The respective 1970 populations for individual Eastern European countries were: Bulgaria - 8.490 million people, Czechoslovakia - 14.334, East Germany - 17.058, Hungary - 10.338, Poland - 32.526, Romania - 20.250, the CMEA Six taken together - 102.997.

⁸For a detailed description of these categories of non-market benefits, see Marrese and Vanous [1980a].

⁹The Military Balance: 1979-1980[1979], p.13.

¹⁰Jones [1979], p.125.

¹¹Jackson [1977], p.893

¹²The Military Balance. Annual volumes from 1960 to 1979.

¹³The GDR has been by far the most active participant among CMEA Six countries in the propagation of Soviet political ideology. In order to evaluate the quality and composition of each country's armed forces, see The Military Balance, annual volumes from 1960 to 1979.

¹⁴A detailed explanation of the data and the methodology utilized by the authors in the construction of RIGID will be presented in a forthcoming paper.

¹⁵It is well-known that, in general, the estimated coefficients of a non-linear model are asymptotically normally distributed. In a small sample such as this, we are not certain that these asymptotic properties are valid, so the exact distribution is unknown. However, pseudo t-statistics greater than 4, such as ours, would probably reject the null hypothesis under any distribution which approaches normality. Furthermore, by Chebyshev's inequality (see Theil [1971, p.63]), under any distribution a pseudo t-statistic of 4 would reject at the 93.75% level.

¹⁶Published Durbin-Watson statistics apply only to linear regression models with an intercept (see Savin and White [1978]).

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